United States Department of Agriculture

Soil Conservation Service

Forest Service

In cooperation with Michigan Department of Agriculture, Michigan Technological University, Michigan Agricultural Experiment Station, and Michigan Cooperative Extension Service

Soil Survey of Newaygo County, Michigan

How To Use This Soil Survey

General Soil Map

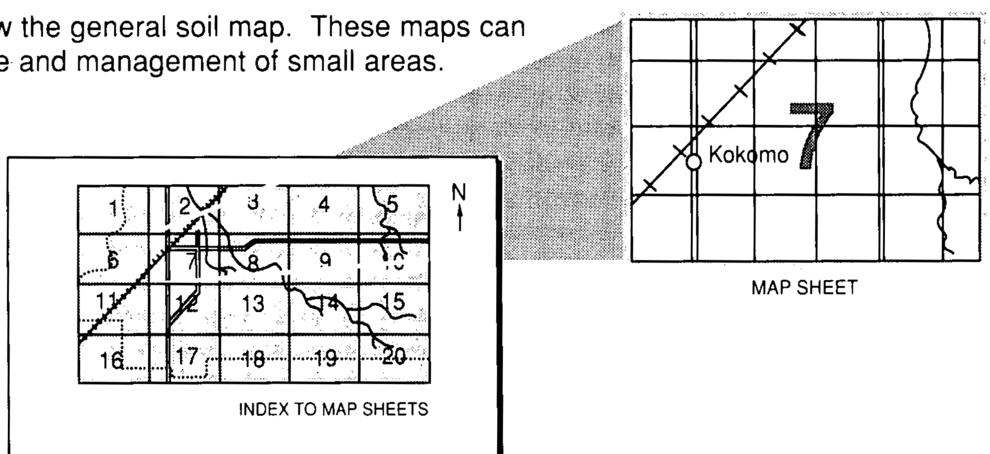
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

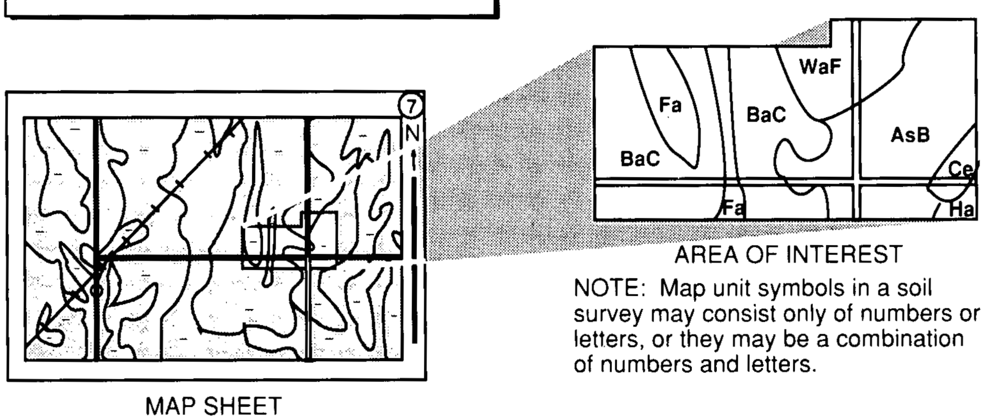
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1989. Soil names and descriptions were approved in 1990. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1989. This survey was made cooperatively by the United States Department of Agriculture, Soil Conservation Service and Forest Service; Michigan Department of Agriculture; Michigan Technological University; Michigan Agricultural Experiment Station; and Michigan Cooperative Extension Service. The survey is part of the technical assistance furnished to the Newaygo County Conservation District. The Newaygo County Board of Commissioners provided financial assistance for the survey.

Cover: Stripcropping in an area of Metea-Marlette-Spinks complex, 6 to 12 percent slopes, and Marlette loam, moderately wet, 1 to 6 percent slopes. Napoleon peat is in the low-lying area in the foreground.

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Issued February 1995

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Foreword

This soil survey contains information that can be used in land-planning programs in Newaygo County, Michigan. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Homer R. Hilner
State Conservationist
Soil Conservation Service

Soil Survey of Newaygo County, Michigan

By Thomas H. Purkey, Soil Conservation Service

Fieldwork by Thomas H. Purkey, Robert E. Evon, and Kenneth W. Farrish, Soil Conservation Service; Mary I. Dugan, Saiid Mahjoory, and Terri M. Smith, Michigan Department of Agriculture; and Richard L. Watson, United States Department of Agriculture, Forest Service

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with
Michigan Department of Agriculture, Michigan Technological University, Michigan Agricultural Experiment Station, and Michigan Cooperative Extension Service

NEWAYGO COUNTY is in the west-central part of the Lower Peninsula of Michigan (fig. 1). It is about 24 miles wide and 36 miles long. It has an area of 551,757 acres, or about 862 square miles, of which 9,760 acres is water. White Cloud, the county seat, is in the central part of the county. In 1984, the county had a population of 36,238.

This soil survey updates the survey of Newaygo County published in 1951 *(12)*. It provides additional interpretive information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section provides general information about Newaygo County. It describes climate, history and development, physiography and relief, lakes and streams, and farming.

Climate

Prepared by the Michigan Department of Agriculture, Environmental Division, Climatology Program, East Lansing, Michigan.

The climate of Newaygo County is highly varied because of topographical variations and the proximity of the county to Lake Michigan. The climatological records kept in the county are not considered reliable. Therefore, this report gives data from stations in Baldwin, which is about 6 miles north of the county; Big Rapids, about 4 miles east of the county; and Hesperia, west of the county, near the Newaygo-Oceana County line. Baldwin is in Lake County; Big Rapids, in Mecosta County; and Hesperia, in Oceana County.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Baldwin, Big Rapids, and Hesperia in the years 1951 through 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 22.0 degrees F at Baldwin, 21.9 degrees at Big Rapids, and 22.9 degrees at Hesperia. The average daily minimum temperature is 12.5 degrees at Baldwin, 13.4 degrees at Big Rapids, and 14.6 degrees at Hesperia. The lowest temperature on record is -49 degrees at Baldwin, -36 degrees at Big Rapids, and -35 degrees at Hesperia. In summer the average daily maximum temperature is 81.1 degrees at Baldwin, 79.6 degrees at Big Rapids, and 80.1 degrees at Hesperia. The highest recorded temperature is 104 degrees at Baldwin, 103 degrees at Big Rapids, and 100 degrees at Hesperia.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the

Figure 1.—Location of Newaygo County in Michigan.

average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 33.97 inches at Baldwin, 31.90 inches at Big Rapids, and 33.57 inches at Hesperia. Of these totals, 19.18 inches at Baldwin, 18.52 inches at Big Rapids, and 18.91 inches at Hesperia usually fall in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 15.81 inches at Baldwin, 15.20 inches at Big Rapids, and 14.94 inches at Hesperia. The heaviest 1-day rainfall during the period of record was 3.75 inches at Baldwin, 4.55 inches at Big Rapids, and 6.19 inches at Hesperia. Thunderstorms occur on about 34 days each year at Baldwin and 36 days each year at Big Rapids and Hesperia. June, July, and August each have an average of six thunderstorms.

The average seasonal snowfall is 82.7 inches at Baldwin, 70.5 inches at Big Rapids, and 75.5 inches at Hesperia. The greatest snow depth at any one time during the period of record was 41 inches at Baldwin, 38 inches at Big Rapids, and 30 inches at Hesperia. On the average, 111 days at Baldwin, 103 days at Big Rapids, and 97 days at Hesperia have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The heaviest 1-day snowfall on record was 33.5 inches at Baldwin, 16.0 inches at Big Rapids, and 11.0 inches at Hesperia. The greatest monthly snowfall was 65.3 inches at Baldwin, 44.5 inches at Big Rapids, and 48.1 inches at Hesperia. The greatest seasonal snowfall was 126.1 inches at Baldwin, 115.3 inches at Big Rapids, and 120.0 inches at Hesperia. The least seasonal snowfall was 23.5 inches at Baldwin, 13.0 inches at Baldwin, and 30.1 inches at Hesperia.

The average relative humidity at 1 p.m. is about 62 percent at all three stations. Humidity is higher at night, and the average at 7 a.m. is about 83 percent. The prevailing wind is from the southwest. Average windspeed is highest, 11.3 miles per hour, in January. The sun shines 62 percent of the time possible in summer and 30 percent in winter.

History and Development

From 11,000 years ago until the arrival of the first Europeans in Michigan, various Indian peoples periodically occupied what is now Newaygo County. During the retreat of the last glacier, tundra and forests of spruce covered the landscape. Indians of the Paleo Period followed caribou into what is now Michigan *(6)*. Projectile points (fluted, lanceolate points) that were used by the Indians have been found north of the Muskegon River in Newaygo County *(16)*.

By 2000 B.C., the forests and rivers began to look like those of today. Between 2000 B.C. and about 500 B.C., Indians of the Archaic Period hunted deer in winter and fished in summer *(6)*. By about 100 B.C., the Hopewell Indians lived in what is now Newaygo County. The Hopewell culture probably extended as far north as the Muskegon River in Newaygo County. Artifacts from this period have been found in numerous mounds on the river bluffs between Newaygo and Croton, where the Hopewell Indians buried artifacts with their dead *(16)*.

The Mallon Mounds near Brooks Lake and other mounds date from the Woodland Period (700 to 1000 A.D.). Indians of this period were probably the progenitors of the Ottawa Indians, who made contact with the first Europeans *(16)*. The Ottawas engaged mainly in specialized fur trapping. They exchanged furs for agricultural products grown to the south *(15)*. They fished in summer and hunted in winter. Archaeological evidence at sites in Oceana County indicates that their prey were buffalo, beaver, and elk.

The first Europeans to navigate the Muskegon River

were French trappers who traded with the Indians well before recorded history. The earliest permanent trading post on the Muskegon River dates to about 1834. Another trading post was established at Old Woman's Bend, 2 miles below the present city of Newaygo *(19)*.

European settlement of Newaygo County began with lumbering. When the Indians gave up title to their land following the Treaty of 1836, speculators came to Newaygo County from Chicago. They established claims over vast timber resources, established squatter's rights at river mouths, and ran sawmills with water power. Newaygo was the first European settlement in the county. For the next 60 years, logging had the biggest influence on settlement in the county. Newaygo and Croton became important logging centers. It is believed that more logs have floated down the Muskegon River than any other river in the world *(20)*. As the timber along the river was removed, roads and railroads were built to transport logs. In about 50 years, the forest and the soils were forever changed as a result of clearcutting, forest fires, and farming.

The crops in the areas of cleared forest were used to feed the growing population in the lumbering camps. Several hundred acres were cultivated during the mid-1800's in an area of remnant prairie in what is now Big Prairie Township. The soil in this area was a Sparta sand that had a 12- to 18-inch layer of mixed sand and organic material. It was devoid of trees and could be easily farmed. The fertility of the soil was fair, and good crops were produced during the first few years. After removal of the plant cover and depletion of plant nutrients, however, the soil was dry and subject to soil blowing. In some areas 2 to 3 feet of soil was eroded. As a result, the largest area of desert east of the Mississippi River was created *(4)*. This area became a tourist attraction until it was reforested. Plantations of pine now cover much of the area.

By the last quarter of the 19th century, some of the more affordable wetlands were converted to farmland *(13)*. In the early 20th century, Rice Lake, in Grant Township, was drained. Its lakebed is now used for specialty crops *(21)*. As the logging industry slowed and the extent of farming increased, a canning factory established in Fremont to market the produce grew into a big business.

Not all of the land that was originally settled was suitable for farming, and many farms were later abandoned. Farmland that reverted to the Federal Government is today managed as the Manistee National Forest. Other farmland was purchased for use as recreational areas. The current economy of the county depends on farming, recreation, and timber products from the second-growth forest.

Physiography and Relief

The bedrock in Newaygo County consists of the edges of bowlike formations that fill the Michigan Basin. Marshall Sandstone underlies all of the county. It is the uppermost bedrock in the western half of the county. The Michigan Formation overlies the Marshall Sandstone in the eastern half of the county. This formation is primarily limestone, gypsum, and dolomite interbedded with shale and sandstone. To the east, Bayport Limestone and Parma Sandstone progressively overlie these rocks. In the central part of the county and in some areas in the eastern half, red beds overlie the Michigan, Saginaw, and Grand River Formations. They consist mainly of sandstone, shale, clay, and minor beds of limestone and gypsum *(3)*.

Overlying the rock formations is a mass of glacial drift, which was deposited after the Wisconsinan Glaciation. The glacial drift ranges from 200 to 800 feet in thickness. It is coarse gravel to fine lacustrine clay. Many of the soils in the county formed in the drift.

The present surface features in the county generally are the result of glacial action. Two major physiographic regions are recognized in the county *(9)*. One consists of several outwash plains and lake plains in nearly level valleys having definite boundaries (fig. 2). Glacial meltwater streams, which were much larger than the current rivers and streams, deposited outwash material in the valleys. The abandoned meltwater channels are filled with organic deposits in some areas and are kettle lakes in others. As the ice receded and the levels of the glacial lakes dropped, the valleys were incised and terraces formed along the present streams and rivers. The other physiographic region consists of rolling and hilly morainic areas rising from the nearly level valleys or plains. These areas consist of ground, end, recessional, and disintegration moraines.

Streams and rivers have greatly modified the surface in Newaygo County only in the valley of the Muskegon River. The surface remains much as it was when the last glaciers receded.

The lowest elevation in the county is 600 feet above mean sea level. It is in an area where the Muskegon River exits the southwestern part of the county. The highest elevation is 1,300 feet above mean sea level. It is in an area in the far northeastern part of the county.

Lakes and Streams

Newaygo County has abundant surface and ground water resources. The ground water is a source of good-quality drinking water for residents of the county. The 460 natural lakes, 234 of which are larger than 1.3

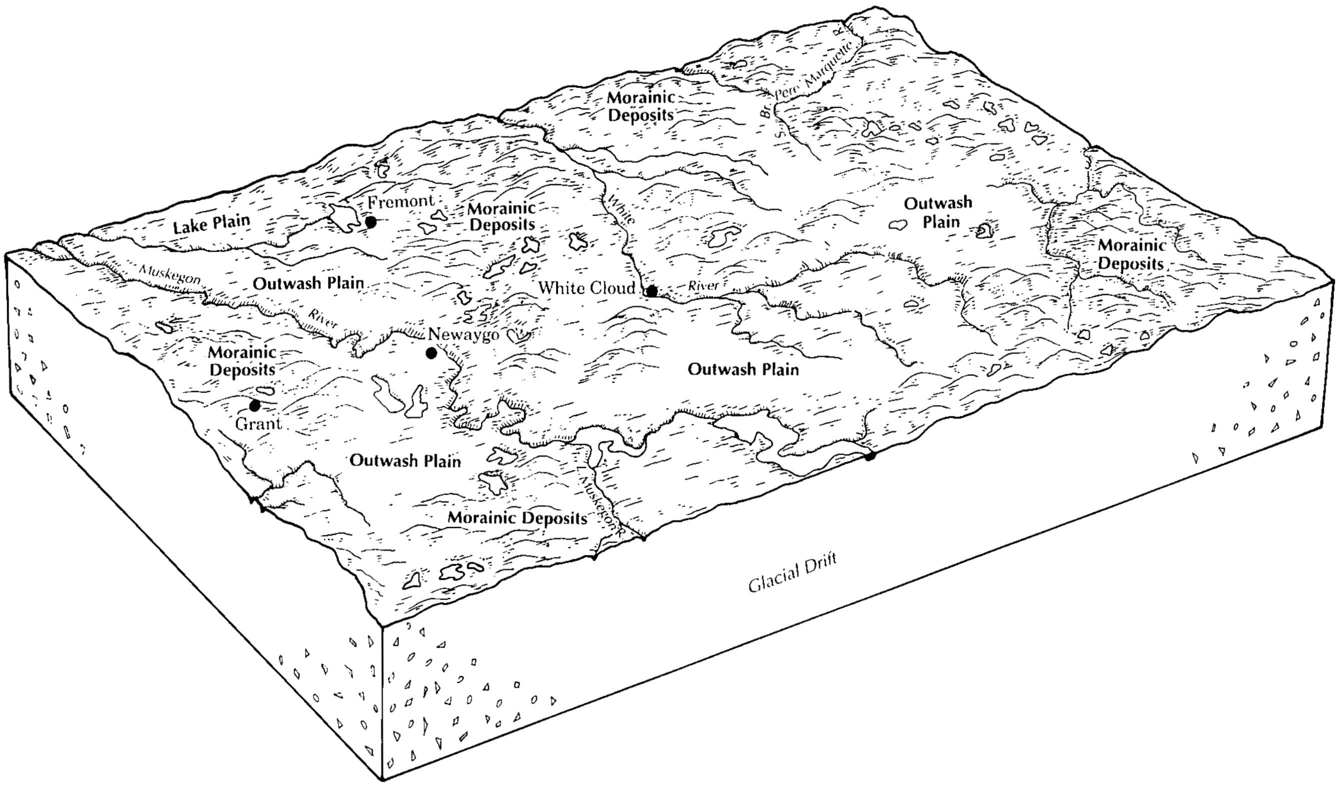

Figure 2.—Physiography of Newaygo County, Michigan.

acres in size, and the 356 miles of streams in the county provide ample opportunities for recreation. Hydroelectric dams on the Muskegon River have formed two manmade lakes—Hardy Pond, which is 2,845 acres in size, and Croton Dam Pond, which is 1,235 acres in size. These lakes provide opportunities for recreation *(14)*.

Most of the larger natural lakes are in the southern half of the county. They are within 10 miles of the city of Newaygo. Hess Lake, the largest, is 1,125 acres in size, and Fremont Lake, the next largest, is 790 acres in size. Brooks, Bills, Pickerel, Brookings, and Ryerson Lakes are all larger than 200 acres in size. The areas around the larger lakes have been intensively developed for residential uses. In some of the lakes in the county, there are problems with water quality because the soils around the lakes are sandy and are used intensely for residential and agricultural purposes. Algae blooms, for example, have occurred in some areas where the lakes have received runoff containing phosphorus from fertilized fields. Nearly all of the lakes have high-quality water that requires only initial treatment to be suitable for food processing and drinking. Exceptions are Hess, Fremont, Peterson, and Hesperia Lakes. The smaller lakes in the public forests provide opportunities for recreational activities. Numerous unnamed bodies of water provide habitat for many species of wetland wildlife.

Newaygo County is drained by several rivers. The northern part of the county is drained by the Pere Marquette and Little Pere Marquette Rivers. The White River originates in the central plain in the county and flows west. The Muskegon River drains a large area in the middle and southern parts of the county. Crockery Creek and the Rogue River, which are in the southernmost part of the county, drain into the Grand River.

Farming

Glenn Lamberg, district conservationist, and Maya Hamady, soil conservationist, Soil Conservation Service, helped prepare this section.

About 160,100 acres in Newaygo County, or 29 percent of the total acreage, is farmland. About 103,600 acres is used for crops or pasture. About 4,600 acres is used as permanent pasture. Because most row crop rotations include several years of hay or pasture, the

combined acreage of pasture and hayland in any one year is estimated at about 56,000 acres. Of the acreage used as cropland, roughly 90,000 acres is used for row crops, mostly corn; 3,000 acres is used for orchard crops, mainly apples, peaches, cherries, plums, and pears; and 6,000 acres is used for vegetable crops, mainly mint, asparagus, celery, squash, peppers, turnips, cabbage, tomatoes, parsnips, and sweet corn. In 1986, about 25,000 acres was used for corn and 3,950 acres for small grain, mainly oats and wheat. An estimated 4,000 acres is used for Christmas tree farms. Dairy products and livestock also are important parts of the agriculture in the county.

Because many of the soils are suitable for cropland, the climate is favorable, and markets for farm products are nearby, farming probably will continue to be an important part of the economy in Newaygo County. The available farmland has been under increasing pressure from nonagricultural uses, such as building site development.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; and the kinds of crops and native plants growing on the soils. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they

drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They are described but are not identified by name in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are identified by name in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

Survey Procedures

The general procedures followed in making this survey are described in the "National Soils Handbook" of the Soil Conservation Service *(26)*. The Huron-Manistee National Forest ecological classification system was used in conjunction with the handbook to prepare the soil survey on most of the Forest Service lands and on some private tracts within the administrative boundary of the Manistee National Forest *(5)*. The map units on the Forest Service lands were designed differently from those in other parts of the survey area. The Soil Conservation Service and the Michigan Department of Agriculture mapped most of the private and State lands. The Forest Service mapped most of the Federal lands.

The ecological classification system is an integrated system that includes evaluation and classification of landscape areas. Ecological units are mapped on aerial photographs, and interpretations are made from inventory maps for use in forest land and resource management.

General Procedures

The soil survey maps made for conservation planning prior to the start of the project and the survey of Newaygo County published in 1951 *(12)* were among the references used in making this survey. Before the fieldwork began, preliminary boundaries of slopes and landforms were plotted stereoscopically on 1:15,840 leaf-off aerial photography. U.S. Geologic Survey topographic maps, at a scale of 1:24,000, helped the soil scientists to relate land and image features.

A reconnaissance was made by pickup truck before the soil scientists traversed the surface on foot, examining the soils. In areas where the soil pattern is very complex, traverses and random observations were spaced as close as 200 yards. In areas where the soil pattern is relatively simple, traverses were about 0.25 mile apart.

As they traversed the surface, the soil scientists divided the landscape into segments. For example, a hillside was separated from a swale and a gently sloping ridgetop from a very steep side slope.

Observations of such items as landforms, blown-down trees, vegetation, and roadbanks were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. The soil material was examined with the aid of a hand auger or a spade to a depth of about 5 feet. The pedons described as typical were observed and studied in pits that were dug with shovels, mattocks, and digging bars.

Extensive notes were taken on the composition of

map units during the first year of the project. These notes were supplemented by additional notes as mapping progressed and the composition of individual map units was determined.

Samples for chemical and physical analyses were taken from representative sites of some soils in the survey area. The analyses were made by the Soil Research Laboratory, Michigan Technological University, Houghton, Michigan, and the Soil Survey Laboratory, Lincoln, Nebraska. The results of the studies can be obtained on request from the two laboratories or from the Michigan State Office, Soil Conservation Service, East Lansing, Michigan.

After the completion of soil mapping on aerial photographs, map unit delineations were transferred by hand to another set of the same photographs. Cultural features were recorded from observations of the maps and the landscape.

Procedures in the Huron-Manistee National Forest

Before ecological units were mapped, information about the climate, geology, soils, hydrology, and vegetation in the survey area was collected. Research techniques were used in mid-late successional stands to collect information on vegetative and soil components in areas on uplands. Samples were not collected on early successional aspen stands, young stands, plantations, or stands disturbed by recent harvesting or by fires. The results were used in developing ecological map units that are defined on the basis of either abiotic landscape characteristics, such as climate and landforms, which generally are stable through time, or biotic landscape characteristics, such as vegetation, which generally are unstable through time.

A premapping reconnaissance was conducted in the survey area before the start of the field inventory. An important result of the reconnaissance activities was a list of the ecological units expected to be mapped in the area, a definition of the features differentiating the units, and a set of specific sites in the Manistee National Forest where detailed data had been collected and analyzed in the laboratory for quality control.

Following reconnaissance, the mapping personnel traversed the landscape, evaluated the components of the current ecosystems, determined and observed the boundaries of the ecological units in the field, and delineated preliminary map units on aerial photographs. During field mapping, stereo images, photo tones, and photo colors were used to delineate landscape features on the aerial photographs. Some important characteristics used by the field personnel to evaluate the context of an area included water table levels, soil texture and color, drainage systems, geologic indicators, and interpretation of groups of vegetative species.

Mappers inventoried 300 to 500 acres per day. During a typical day, they performed detailed evaluations and completed note cards on 10 to 15 strategically selected sites. The landscape features were examined, and data on overstory, understory, ground flora, forest floor, soil, substratum, and ground water were collected. Sandy soils were described to a depth of 15 feet. These data are a permanent part of the forest records available at the office of the supervisor of the Huron-Manistee National Forest.

Following field inventory, the final boundaries of the ecological units were drawn on the aerial photographs. The completed photography was checked for line closure and for matching of delineations across photographs.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some of the boundaries on the general soil map of Newaygo County do not match those on the maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences result from modifications or refinements in soil series concepts and from variations in the intensity of mapping or in the extent of the soils in the counties.

Soil Descriptions

1. Plainfield-Grattan-Brems Association

Nearly level to steep, excessively drained and moderately well drained, sandy soils on outwash plains and moraines

This association consists mainly of Plainfield soils on outwash plains and Grattan and Brems soils on outwash plains and moraines. Slope ranges from 0 to 30 percent.

This association makes up about 30 percent of the county. It is about 47 percent Plainfield and similar soils, 32 percent Grattan and similar soils, 11 percent Brems and similar soils, and 10 percent soils of minor extent.

Plainfield soils are nearly level to rolling and are excessively drained. Typically, the surface layer is black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The underlying material to a depth of 60 inches is very pale brown sand.

Grattan soils are nearly level to steep and are excessively drained. Typically, the surface layer is black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The underlying material to a depth of 60 inches is strong brown sand.

Brems soils are nearly level and very gently sloping and are moderately well drained. Typically, the surface layer is dark brown sand about 8 inches thick. The subsoil is mottled sand about 38 inches thick. The upper part is strong brown and very friable, and the lower part is brownish yellow and loose. The underlying material to a depth of 60 inches is light yellowish brown, mottled, loose sand.

The minor soils in this association include the excessively drained Sparta and Coloma soils. Sparta soils are on flats and knolls, and Coloma soils are on flats, knolls, and ridges.

Most areas of this association are used as woodland and wildlife habitat. Because of soil blowing and droughtiness, the major soils are generally unsuited to cropland and poorly suited to pasture. They are fairly well suited to woodland. The equipment limitation, the hazard of erosion, and seedling mortality are the major concerns in managing woodland.

The major soils are well suited, fairly well suited, or poorly suited to building site development, depending on the slope. They are poorly suited to septic tank absorption fields because of a poor filtering capacity.

2. Cosad-Del Rey-Sickles Association

Nearly level and gently undulating, somewhat poorly drained and poorly drained, sandy and loamy soils on lake plains

Areas of the major soils in this association are intermingled on broad plains, low ridges, and knolls. Slope ranges from 0 to 4 percent.

This association makes up about 3 percent of the

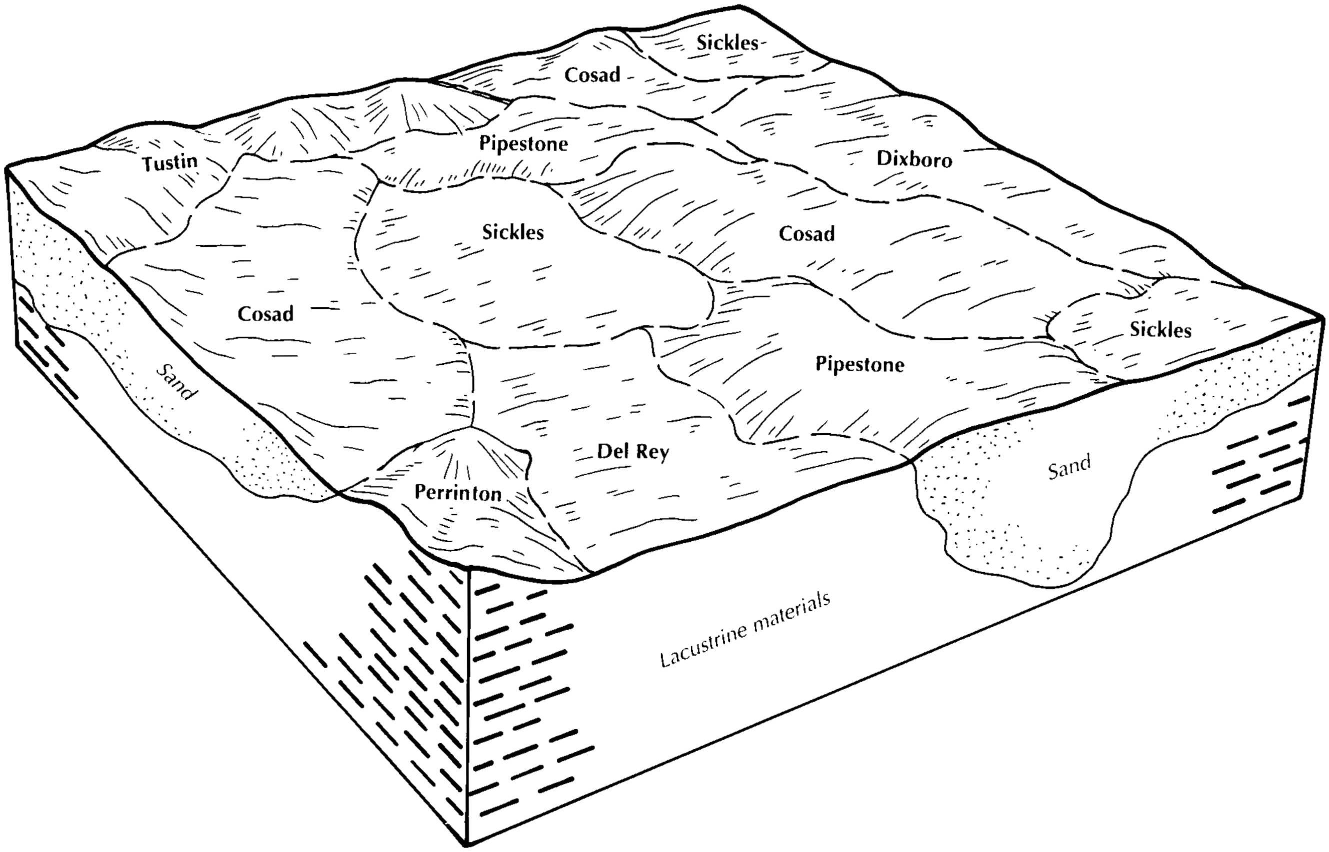

Figure 3.—Typical pattern of soils and parent material in Cosad-Del Rey-Sickles association.

county. It is about 35 percent Cosad and similar soils, 26 percent Del Rey and similar soils, 18 percent Sickles and similar soils, and 21 percent soils of minor extent (fig. 3).

Cosad soils are somewhat poorly drained. Typically, the surface layer is very dark gray loamy sand about 12 inches thick. The subsoil is pale brown, mottled, very friable loamy sand about 9 inches thick. The underlying material to a depth of 60 inches is grayish brown, mottled silty clay loam.

Del Rey soils are somewhat poorly drained. Typically, the surface layer is dark brown loam about 11 inches thick. The subsurface layer is light brownish gray and brown, mottled loam about 4 inches thick. The subsoil is about 9 inches of dark yellowish brown and yellowish brown, mottled, firm silty clay loam and very fine sandy loam. The underlying material to a depth of 60 inches is brown, mottled silty clay loam.

Sickles soils are poorly drained. Typically, the surface layer is black loamy fine sand about 8 inches thick. The next layer is grayish brown, very friable loamy fine sand about 12 inches thick. Below this is about 7 inches of light brownish gray, mottled, friable, stratified loamy fine sand and silt loam. The underlying material to a depth of 60 inches is brown, mottled silty clay.

The minor soils in this association include Dixboro, Pipestone, Perrinton, and Tustin soils. Dixboro soils are somewhat poorly drained and are on nearly level plains and along the upper edges of some drainageways. Pipestone soils are somewhat poorly drained and are on flats and slight rises. Perrinton and Tustin soils are well drained and are on the tops and sides of ridges.

Most areas of this association are used as cropland. Some areas are used as woodland or are left idle. The major soils are well suited to cropland. Wetness, water erosion, and soil blowing are the major concerns in managing cropland. If the sandy soils are drained, drought is a hazard. The major soils are fairly well suited to woodland. The equipment limitation, seedling mortality, and the hazard of windthrow are the major concerns in managing woodland.

The major soils are poorly suited or generally unsuited to septic tank absorption fields and building

site development. Wetness and restricted permeability are the major management concerns.

3. Glendora-Abscota-Algansee Association

Nearly level and gently undulating, very poorly drained, somewhat poorly drained, and moderately well drained, sandy and loamy soils on flood plains

This association consists mainly of Glendora soils, commonly on the first bottoms of flood plains, and Abscota and Algansee soils on the first or second bottoms of flood plains and on natural levees in areas of the first bottoms. Slope ranges from 0 to 3 percent.

This association makes up about 5 percent of the county. It is about 64 percent Glendora and similar soils, 20 percent Abscota and similar soils, 12 percent Algansee and similar soils, and 4 percent soils of minor extent.

Glendora soils are nearly level and very poorly drained. Typically, the surface layer is black mucky sand about 5 inches thick. The next 8 inches is light brownish gray, mottled, very friable loamy fine sand. The next 7 inches is brown, mottled, loose sand that has streaks of fine sandy loam. The next 3 inches is dark gray, mottled, very friable loamy fine sand. The underlying material to a depth of 60 inches is gray, dark gray, and brown, mottled sand and very gravelly sand.

Abscota soils are nearly level and very gently sloping and are moderately well drained. Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is dark brown, very friable loamy fine sand about 7 inches thick. The underlying material to a depth of 60 inches is dark yellowish brown, brownish yellow, light yellowish brown, and very pale brown, mottled sand.

Algansee soils are nearly level and very gently sloping and are somewhat poorly drained. Typically, the surface layer is dark grayish brown loamy fine sand about 7 inches thick. The next layer is brown, friable loamy fine sand about 5 inches thick. Below this to a depth of 60 inches is very pale brown and light gray, mottled fine sand.

The minor soils in this association include Ceresco and Adrian soils. Ceresco soils are somewhat poorly drained and are on natural levees and first bottoms. Adrian soils are very poorly drained and are in swales and low areas on the flood plains.

Most areas of this association are used as woodland or are left idle. A few areas are used as cropland. Abscota and Algansee soils are fairly well suited to cropland and well suited to woodland. Glendora soils are generally unsuited to cropland. Wetness and flooding are the major concerns in managing cropland. If the sandy soils are drained, drought is a hazard. Soil blowing is a hazard on the sandy soils. The equipment limitation and the hazard of windthrow are the major concerns in managing woodland.

The major soils are generally unsuited to septic tank absorption fields and building site development because of wetness and flooding.

4. Marlette-Metea-Spinks Association

Nearly level to steep, moderately well drained and well drained, loamy and sandy soils on moraines

This association consists mainly of Marlette, Metea, and Spinks soils on flats, knolls, and ridges. Slope ranges from 0 to 40 percent.

This association makes up about 17 percent of the county. It is about 30 percent Marlette and similar soils, 26 percent Metea and similar soils, 19 percent Spinks and similar soils, and 25 percent soils of minor extent.

Marlette soils are nearly level to rolling and are well drained and moderately well drained. Typically, the surface layer is dark grayish brown loam about 8 inches thick. The next layer is brown and pale brown, friable loam about 8 inches thick. The subsoil is brown, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam.

Metea soils are nearly level to steep and are well drained. Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam.

Spinks soils are nearly level to steep and are well drained. Typically, the surface layer is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand.

The minor soils in this association include the well drained Perrinton soils, the somewhat poorly drained Selfridge soils, and the poorly drained Parkhill soils. Perrinton soils are on knolls and ridges. Selfridge and Parkhill soils are in depressions, in drainageways, and on low flats.

Most areas of this association are used as cropland. Some areas are used as woodland and wildlife habitat. The nearly level to undulating soils are well suited or fairly well suited to cropland. The soils that have slopes of more than 12 percent are poorly suited or generally unsuited to cropland. Water erosion is a hazard. Deterioration of tilth in the Marlette soils and

droughtiness and soil blowing in areas of the Metea and Spinks soils are additional management concerns. All of the major soils are well suited to woodland. Erosion and the equipment limitation are concerns in managing woodland in the more sloping areas.

The major soils are well suited, fairly well suited, poorly suited, or generally unsuited to building site development and septic tank absorption fields. The slope is a management concern on the undulating to very steep soils. Moderately slow permeability in the Marlette and Metea soils also is a management concern.

5. Coloma-Spinks-Metea Association

Nearly level to steep, excessively drained and well drained, sandy soils on moraines

This association consists mainly of Coloma, Spinks, and Metea soils on knolls and ridges. Slope ranges from 0 to 40 percent.

This association makes up about 26 percent of the county. It is about 47 percent Coloma and similar soils, 13 percent Spinks and similar soils, 11 percent Metea and similar soils, and 29 percent soils of minor extent.

Coloma soils are excessively drained. Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand.

Spinks soils are well drained. Typically, the surface layer is dark brown, loose loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand.

Metea soils are well drained. Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown clay loam.

The minor soils in this association include the excessively drained Grattan soils, the somewhat poorly drained Pipestone soils, the excessively drained Plainfield soils, and the somewhat poorly drained Selfridge soils. Pipestone and Selfridge soils are in depressions, in drainageways, and on low flats on moraines. Grattan and Plainfield soils are on knolls and ridges.

Most areas of this association are used as woodland. Some areas are used as cropland or wildlife habitat. The nearly level to undulating soils are fairly well suited or poorly suited to cropland. The soils that have slopes of more than 12 percent are poorly suited or generally unsuited to cropland because of the hazard of water erosion. Droughtiness and soil blowing are the major concerns in managing cropland. All of the major soils are well suited to woodland. Erosion and the equipment limitation are concerns in managing woodland in the sloping to steep areas. Seedling mortality also is a concern in managing woodland.

Depending on the slope, the major soils are well suited, fairly well suited, poorly suited, or generally unsuited to building site development and septic tank absorption fields. The slope of all three soils, a poor filtering capacity in the Coloma soils, and moderately slow permeability in the subsoil of the Metea soils are the major management concerns.

6. Toogood-Boyer Association

Nearly level to steep, somewhat excessively drained to moderately well drained, sandy soils on outwash plains and terraces

This association consists mainly of Toogood and Boyer soils on broad, flat plains, on the side slopes of drainageways, and on ridges and knolls. Slope ranges from 0 to 18 percent.

This association makes up 4 percent of the county. It is about 60 percent Toogood and similar soils, 30 percent Boyer and similar soils, and 10 percent soils of minor extent.

Toogood soils are nearly level to rolling and are somewhat excessively drained and moderately well drained. Typically, the surface layer is black loamy sand about 4 inches thick. The upper part of the subsoil is dark brown, very friable loamy sand about 4 inches thick. The next part is yellowish brown, very friable loamy sand about 26 inches thick. The lower part is dark brown, very friable gravelly sandy loam about 2 inches thick. The underlying material to a depth of 60 inches is light yellowish brown gravelly coarse sand.

Boyer soils are nearly level to steep and are well drained. Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, very friable loamy sand. The lower part is reddish brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand.

The minor soils in this association include Coloma soils, the Granby soils that have a gravelly substratum, and Kingsville and Watseka soils. The somewhat excessively drained Coloma soils are on broad, flat plains, on the side slopes of steep drainageways, and

on ridges and knolls. The somewhat poorly drained Watseka soils, the poorly drained Granby soils that have a gravelly substratum, and the poorly drained Kingsville soils are on low plains, in depressions, and in drainageways.

Most areas of this association are used as woodland. Some areas are used as cropland. Toogood soils are poorly suited or generally unsuited to cropland, and Boyer soils are fairly well suited. Drought and soil blowing are hazards. In areas that have slopes of more than 6 percent, water erosion also is a hazard. The major soils are well suited, fairly well suited, or poorly suited to woodland. Seedling mortality is a management concern on the Toogood soils. The equipment limitation is a management concern in the steeper areas of the Boyer soils.

The major soils are well suited, fairly well suited, poorly suited, or generally unsuited to building site development. The slope is a limitation in the strongly sloping to steep areas. The major soils are fairly well suited, poorly suited, or generally unsuited to septic tank absorption fields. A poor filtering capacity is the main management concern. The slope also is a concern in some areas.

7. Adrian-Carlisle-Martisco Association

Nearly level, very poorly drained, organic soils on lake plains and outwash plains

The major soils in this association are on broad, smooth or slightly concave plains, in depressions, and in drainageways. Slope ranges from 0 to 2 percent.

This association makes up about 4 percent of the county. It is about 50 percent Adrian and similar soils, 24 percent Carlisle and similar soils, 10 percent Martisco and similar soils, and 16 percent soils of minor extent.

Typically, the surface layer of the Adrian soils is black muck about 5 inches thick. The next 14 inches also is black muck. The underlying material to a depth of 60 inches is light brownish gray and gray sand and loamy sand.

Typically, the surface layer of the Carlisle soils is black muck about 18 inches thick. The underlying layers to a depth of 60 inches are black and very dark brown muck.

Typically, the surface layer of the Martisco soils is black muck about 11 inches thick. The underlying material to a depth of 60 inches is olive gray marl.

The minor soils in this association include the very poorly drained Edwards, poorly drained Kingsville, and somewhat poorly drained Thetford soils. Edwards soils are on broad, smooth or slightly concave plains, in depressions, and in drainageways. Kingsville soils are on slight rises and in other areas on broad plains. Thetford soils are on slight rises and low ridges.

Most areas of this association are used as woodland. The largest single area is used for truck crops. The major soils are poorly suited to cropland. Wetness, soil blowing, and subsidence are the major management concerns. All of the major soils are poorly suited to woodland. The equipment limitation, seedling mortality, and the hazard of windthrow are concerns in managing woodland.

The major soils are generally unsuited to building site development and septic tank absorption fields. Wetness and low strength in all of the major soils are the main management concerns.

8. Pipestone-Covert-Kingsville Association

Nearly level and gently undulating, somewhat poorly drained, moderately well drained, and poorly drained, sandy soils on outwash plains

This association consists mainly of Pipestone soils on broad, smooth or slightly convex plains, on low ridges, and on side slopes; Covert soils on uplands, knolls, and plains; and Kingsville soils on low flats and in depressions and drainageways. Slope ranges from 0 to 5 percent.

This association makes up about 11 percent of the county. It is about 34 percent Pipestone and similar soils, 33 percent Covert and similar soils, 23 percent Kingsville and similar soils, and 10 percent soils of minor extent.

Pipestone soils are nearly level and gently undulating and are somewhat poorly drained. Typically, the surface layer is very dark gray sand about 7 inches thick. The subsurface layer is pale brown, mottled sand about 6 inches thick. The subsoil is about 16 inches of reddish brown and brown, mottled, friable and loose sand that has common chunks and pieces of reddish brown and brown, brittle material. The underlying material to a depth of 60 inches is light yellowish brown, mottled sand.

Covert soils are nearly level and gently undulating and are moderately well drained. Black, well decomposed forest litter about 4 inches thick is on the surface. Typically, the surface layer is pinkish gray sand about 4 inches thick. The subsoil is about 20 inches of dark brown, very friable sand that has a few chunks of dark reddish brown, brittle material. The underlying material to a depth of 60 inches is light yellowish brown, mottled sand.

Kingsville soils are nearly level and poorly drained. Typically, the surface layer is black mucky sand about 7 inches thick. The subsoil is pale brown, loose sand about 28 inches thick. The underlying material to a

depth of 60 inches is brown sand.

The minor soils in this association include the very poorly drained Adrian and poorly drained Jebavy soils on low flats and in depressions and drainageways.

Most areas of this association are used as woodland. Some areas are used as cropland or are left idle. The major soils are poorly suited or generally unsuited to cropland. Drought and soil blowing are hazards. Also, wetness is a concern in managing Kingsville and Pipestone soils. The major soils are well suited, fairly well suited, or poorly suited to woodland. Seedling mortality and the equipment limitation are concerns in managing woodland. Also, windthrow is a concern on Kingsville and Pipestone soils.

The major soils are poorly suited or generally unsuited to building site development and septic tank absorption fields. Wetness in all of the major soils is the main management concern.

Broad Land Use Considerations

Each year, some areas in Newaygo County are developed for residential, commercial, or industrial uses. Deciding what land should be used for urban development is a very important issue. The general soil map is suitable for broad land use planning, but it is not suitable for selecting a site for a specific use.

Extensive areas of soils are severely limited as sites for residential and other urban uses. The seasonal high water table and moderately slow permeability are severe limitations on a large acreage in the Cosad-Del Rey-Sickles association. The seasonal high water table is a severe limitation in areas of the Pipestone-Covert-Kingsville association. Flooding, ponding, and the seasonal high water table are severe limitations in areas of the Glendora-Abscota-Algansee association. The seasonal high water table, ponding, and the instability of organic material are severe limitations in areas of the Adrian-Carlisle-Martisco association. The slope is a severe limitation in parts of the Marlette-Metea-Spinks and Coloma-Spinks-Metea associations.

Some of the soils in the county can be developed for urban uses. These include the less sloping, well drained soils in the Plainfield-Grattan-Brems, Coloma-Spinks-Metea, and Toogood-Boyer associations.

The Cosad-Del Rey-Sickles and Marlette-Metea-Spinks associations are better suited to farming than the other associations. Their suitability should be considered when broad land use decisions are made. A considerable acreage of these associations is already used for building sites, golf courses, or other nonfarm uses.

Some of the soils in the county are well suited to farming but are poorly suited to nonfarm uses. The major soils in the Cosad-Del Rey-Sickles association are examples. Wetness limits farm uses on these soils, but it can be overcome by a drainage system and by land shaping. It cannot be easily overcome on sites for nonfarm uses.

Most of the soils in the county are well suited or fairly well suited to woodland. Many soils are well suited to parks and other recreational areas. Undrained areas of Adrian and other poorly drained or very poorly drained soils provide habitat for many species of wildlife and are good nature study areas.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under the heading "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Plainfield sand, 0 to 6 percent slopes, is a phase of the Plainfield series.

Some map units are made up of two or more major soils. These map units are called soil complexes or undifferentiated groups.

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Selfridge-Capac complex, 0 to 5 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Histosols and Aquents, ponded, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas.* Such areas have little or no soil material and support little or no vegetation. Pits, sand and gravel, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Some of the boundaries on the detailed soil maps of Newaygo County do not match those on the soil maps of adjacent counties, and some of the soil names and descriptions do not fully agree. Differences are the result of modifications or refinements in soil series concepts or variations in the intensity of mapping or in the extent of the soils in the counties.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

Soil Descriptions

2—Glendora mucky sand. This nearly level, very poorly drained soil is on the first bottoms of flood plains. It is frequently flooded. Slope ranges from 0 to 2 percent. Individual areas are narrow to broad and elongated and range from 3 to 150 acres in size.

Typically, the surface layer is black mucky sand

about 5 inches thick. The next 8 inches is light brownish gray, mottled, very friable loamy fine sand. The next 7 inches is brown, mottled, loose sand that has streaks of fine sandy loam. The next 3 inches is dark gray, mottled, very friable loamy fine sand. The underlying material to a depth of 60 inches is gray, dark gray, and brown, mottled sand and very gravelly sand. In places the surface layer is muck less than 16 inches thick.

Included with this soil in mapping are small areas of steep and very steep soils, the somewhat poorly drained Algansee and Ceresco soils, the poorly drained Cohoctah soils, and the very poorly drained Adrian soils. The steep and very steep soils are along the edges of the mapped areas, adjacent to uplands. Algansee and Ceresco soils are on the slightly higher knolls and natural levees. Cohoctah soils are dominantly loamy throughout. They are in landscape positions similar to those of the Glendora soil. Adrian soils are in the slightly lower swales. They have more than 16 inches of muck in the upper part. The steep and very steep soils make up about 5 percent of the unit, and the other included soils make up 10 to 15 percent.

Permeability is rapid in the Glendora soil, and the available water capacity is low. Surface runoff is very slow or ponded. The seasonal high water table is at or near the surface from late fall through late spring and during excessively wet periods.

Most areas are used as woodland or are left idle. Some of the idle areas are covered with brush. Because of flooding and wetness, this soil is generally unsuited to pasture and cropland. Draining the soil is difficult because adequate drainage outlets are not available in all areas.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of equipment is restricted during wet periods, but the equipment can be used when the soil is relatively dry or frozen. Seedling losses may be high because of wetness. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of wetness and flooding, this soil is unsuited to building site development and septic tank absorption fields. Better suited sites generally are available.

The land capability classification is Vlw. The woodland ordination symbol is 3W. The Michigan soil management group is L-4c.

3—Adrian muck. This nearly level, very poorly drained soil is on till plains, outwash plains, and moraines. Slope ranges from 0 to 2 percent. Individual areas are irregularly shaped or oval and range from 2 to 400 acres in size.

Typically, the surface layer is black muck about 5 inches thick. The next 14 inches also is black muck. The underlying material to a depth of 60 inches is light brownish gray and gray sand and loamy sand. In places the muck is less than 16 inches thick.

Included with this soil in mapping are small areas of Edwards, Carlisle, and Kingsville soils. The very poorly drained Edwards and poorly drained Kingsville soils generally are on the edges of the mapped areas. Edwards soils are underlain by marl at a depth of 16 to 50 inches. Kingsville soils are sand throughout. The very poorly drained Carlisle soils generally are in the middle of the mapped areas. They have mineral material at a depth of more than 50 inches. Included soils make up 4 to 15 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic layers of the Adrian soil and rapid in the sandy material. The available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late fall through spring and during excessively wet periods.

Most areas are used as woodland. Some areas are used for shallow-rooted vegetable crops.

This soil is poorly suited to cropland unless it is drained. Where drained, it is used for such crops as corn, carrots, and onions. Wetness, soil blowing, and subsidence are the major management concerns. A subsurface drainage system or open ditches can help to remove excess water. Draining the soil is difficult in many areas because drainage outlets are not readily available. Controlled drainage improves the stability of the soil and reduces the risk of subsidence. Wind stripcropping, windbreaks, vegetative barriers, and cover crops help to control soil blowing. The use of equipment is limited during wet periods.

This soil is fairly well suited to pasture. Grazing when the soil is wet can destroy forage plants and damage soil structure. The legumes and grasses that are tolerant of wet conditions grow best.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy harvesting equipment is limited by wetness and by low soil strength. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. The use of equipment should be restricted to periods when the soil is frozen. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Windthrown trees should be periodically removed.

Because of wetness, subsidence, and low strength, this soil is unsuited to septic tank absorption fields and building site development.

The land capability classification is IVw. The woodland ordination symbol is 2W. The Michigan soil management group is M/4c.

4A—Cosad loamy sand, 0 to 3 percent slopes. This somewhat poorly drained, nearly level and gently undulating soil is in depressions on outwash plains and lake plains. Individual areas range from 2 to 250 acres in size.

Typically, the surface layer is very dark gray loamy sand about 12 inches thick. The subsoil is pale brown, mottled, very friable loamy sand about 9 inches thick. The underlying material to a depth of 60 inches is grayish brown, mottled silty clay loam. In places the subsoil is dark brown.

Included with this soil in mapping are small areas of Del Rey, Pipestone, and Sickles soils. Del Rey soils are somewhat poorly drained and are in landscape positions similar to those of the Cosad soil. They are loamy in the upper part. Pipestone soils are somewhat poorly drained and are in landscape positions similar to those of the Cosad soil or on slight rises. They are sandy throughout. Sickles soils are poorly drained and are in slight depressions. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of the Cosad soil and slow in the lower part. The available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from late fall through spring and during excessively wet periods.

Most areas are used as cropland. Some areas are used as woodland or pasture or are left idle.

This soil is well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are wetness, water erosion, and soil blowing. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. Suitable filtering material may be needed around tile lines to keep fine sand and silt from flowing into the lines. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion and soil blowing and increase the available water capacity. Vegetative barriers and field windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during excessively wet or dry periods help to keep the pasture in good condition. The legumes and grasses that are tolerant of wet conditions grow best in undrained areas.

Where this soil is used as woodland, the equipment limitation is the major management concern. Ruts can form if heavy equipment is used during wet periods. The equipment should be used only when the soil is relatively dry or frozen.

Because of the high water table and a high shrink-swell potential in the underlying material, this soil is poorly suited to building site development. It is generally unsuited to septic tank absorption fields because of the high water table and the slow permeability in the underlying material. Buildings can be constructed on suitable well compacted fill material, which raises the site. Subsurface drains lower the water table. If the foundation reaches to the underlying material, widening the foundation trenches and then backfilling with suitable coarse textured material can help to prevent the structural damage caused by shrinking and swelling. All sanitary facilities should be connected to municipal sewage systems.

The land capability classification is IIIw. The woodland ordination symbol is 3W. The Michigan soil management group is 4/1b.

5B—Pipestone sand, 0 to 4 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is on low knolls and ridges on lake plains and outwash plains. Individual areas are irregular in shape and range from 2 to 375 acres in size.

Typically, the surface layer is very dark gray sand about 7 inches thick. The subsurface layer is pale brown, mottled sand about 6 inches thick. The subsoil is about 16 inches of reddish brown and brown, mottled, friable and loose sand that has common chunks and pieces of brittle material. The underlying material to a depth of 60 inches is light yellowish brown, mottled sand. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Included with this soil in mapping are small areas of Thetford and Kingsville soils. Thetford soils have bands of loamy sand in the subsoil. They are in landscape positions similar to those of the Pipestone soil. Kingsville soils are in slight depressions. Included soils make up less than 10 percent of the unit.

Permeability is rapid in the Pipestone soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from fall through late spring and during excessively wet periods.

Most areas are used as woodland or are left idle. A few areas are used as pasture or cropland.

This soil is poorly suited to corn, but such crops as winter wheat, oats, and blueberries can be grown. The

major management concerns are droughtiness, soil blowing, and wetness. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface can help to control soil blowing and conserve moisture. Growing cover crops and green manure crops and regularly adding organic material to the soil increase the available water capacity and help to control soil blowing. Vegetative barriers and field windbreaks also help to control soil blowing.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during excessively wet or dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Ruts can form if heavy equipment is used during wet periods. The equipment should be used only when the soil is relatively dry or frozen. The trees that can withstand seasonal wetness should be selected for planting. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of wetness, this soil is poorly suited to building site development and generally is unsuitable as a site for septic tank absorption fields. A surface or subsurface drainage system lowers the water table on building sites. Buildings can be constructed on suitable well compacted fill material, which raises the site. All sanitary facilities should be connected to municipal sewage systems. Sites that are better suited to septic systems generally are available.

The land capability classification is IVw. The woodland ordination symbol is 3W. The Michigan soil management group is 5b.

8—Cohoctah fine sandy loam. This nearly level, poorly drained soil is on the first bottoms of flood plains. It is frequently flooded. Slope ranges from 0 to 2 percent. Individual areas are narrow to broad and elongated and range from 3 to 170 acres in size.

Typically, the surface layer is very dark gray fine sandy loam about 11 inches thick. The next 6 inches is grayish brown, mottled sandy loam. The next 13 inches is light brownish gray and dark gray loam that has very dark gray streaks. The underlying material to a depth of 60 inches is very dark gray mucky sandy loam.

Included with this soil in mapping are small areas of steep and very steep soils. Also included are the somewhat poorly drained Algansee and Ceresco soils on the slightly higher knolls and natural levees and the very poorly drained Glendora soils. Glendora soils are dominantly sandy throughout. They are in landscape positions similar to those of the Cohoctah soil. The steep and very steep soils are along the edges of the mapped areas, adjacent to uplands. They make up about 5 percent of the unit. The other included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Cohoctah soil, and the available water capacity is moderate. Surface runoff is very slow. The seasonal high water table is at or near the surface from early fall through spring and during excessively wet periods.

Most areas are used as woodland or are left idle. Some of the idle areas are covered with brush. Because of frequent flooding and wetness, this soil is unsuited to cultivated crops. Draining the soil is difficult because the water table is often at the same level as the water in the adjacent streams.

This soil is poorly suited to pasture. Wetness can be reduced in areas where a surface drainage system can be installed. The forage species that can tolerate the wetness should be selected for planting. Operating equipment during excessively wet periods alters soil structure and can result in compaction. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the main management concerns. The use of equipment should be restricted to periods when the soil is relatively dry or frozen. Because of wetness and flooding, loss of natural tree seedlings can be more than 50 percent. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

Because of wetness and flooding, this soil is unsuited to building site development and septic tank absorption fields. Better suited sites generally are available.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is L-2c.

10B—Sparta sand, 0 to 6 percent slopes. This level to gently sloping, excessively drained soil is in flat or slightly concave areas on outwash plains. Individual areas are irregular in shape and range from 3 to 770 acres in size.

Typically, the surface layer is black sand about 12 inches thick. The subsoil is dark yellowish brown and yellowish brown, loose sand about 20 inches thick. The underlying material to a depth of 60 inches is very pale brown sand. In places the surface layer is thinner and lighter colored.

Permeability is rapid, and the available water

capacity is low. Surface runoff is very slow.

Most areas are planted to pine or support the natural prairie vegetation under which the soil formed. Some areas are planted to Christmas trees. Only a few areas are used for crops.

This soil is poorly suited to many crops, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are droughtiness and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material increase the available water capacity and reduce the susceptibility to soil blowing. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing. Growing small grain crops that are planted in fall or early in spring makes good use of the limited amount of available soil moisture.

This soil is poorly suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Selection of deep-rooted forage species for planting helps to overcome the droughtiness. Limited stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol is 6S. The Michigan soil management group is 5a.

10B3—Sparta sand, 0 to 6 percent slopes, severely eroded. This level to gently sloping, excessively drained soil is in flat or slightly concave areas on outwash plains. Individual areas are irregular in shape and range from 2 to 500 acres in size.

Typically, the surface layer is very dark brown sand about 2 inches or less thick. In many areas it has been completely removed by soil blowing. The subsoil is yellowish brown, loose sand about 8 inches thick. The underlying material to a depth of 60 inches is very pale brown fine sand and sand.

Permeability is rapid, and the available water capacity is low. Surface runoff is very slow.

Most areas are planted to pine. Some areas are unvegetated and are subject to continued soil blowing. This soil is unsuited to pasture and cropland because of droughtiness and soil blowing.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate. Although they can be established on this soil, trees grow very slowly because of past erosion. They are effective in stabilizing the eroding soil and in preventing damage to nearby areas.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol is 6S. The Michigan soil management group is 5a.

10C—Sparta sand, 6 to 12 percent slopes. This moderately sloping, excessively drained soil is on low knolls and on the side slopes of small basins on outwash plains. Individual areas are irregular in shape and range from 3 to 75 acres in size.

Typically, the surface layer is black sand about 12 inches thick. The subsoil is dark yellowish brown and yellowish brown, loose sand about 20 inches thick. The underlying material to a depth of 60 inches is very pale brown sand. In places the surface layer is thinner and lighter colored.

Permeability is rapid, and the available water capacity is low. Surface runoff is very slow.

Most areas are still covered by the natural prairie vegetation under which the soil formed. Some areas are planted to pine. Because of droughtiness and the hazard of soil blowing, this soil is unsuited to cultivated crops. It is poorly suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Selection of deep-rooted forage species for planting helps to overcome the droughtiness. Limited stocking rates, pasture rotation, and restricted use

during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is fairly well suited to building site development and poorly suited to septic tank absorption fields. The slope is a limitation on sites for buildings. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. A poor filtering capacity and the slope are the major management concerns on sites for septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly.

The land capability classification is VIs. The woodland ordination symbol is 6S. The Michigan soil management group is 5a.

11—Martisco muck. This nearly level, very poorly drained soil is in depressions on lake plains and outwash plains. Slope is 0 to 1 percent. Individual areas are irregular in shape and range from 5 to 1,200 acres in size.

Typically, the surface layer is very dark gray muck about 11 inches thick. The underlying layers to a depth of 60 inches are olive gray marl.

Included with this soil in mapping are small areas of Edwards and Adrian soils. Edwards soils are muck to a depth of 16 to 51 inches. Adrian soils are underlain by sand. Both of the included soils are in landscape positions similar to those of the Martisco soil. They make up about 10 percent of the unit.

Permeability is moderate or moderately rapid in the upper part of the Martisco soil and slow in the underlying marl. The available water capacity is low. Runoff is very slow or ponded. The seasonal high water table is at or above the surface from fall through late spring and during excessively wet periods.

Most areas have been drained and are farmed. A few areas have been abandoned.

This soil is poorly suited to most crops unless it is drained. Where the soil is drained, such crops as corn, carrots, and onions can be grown. The choice of crops is limited because the soil is alkaline. Wetness, soil blowing, and subsidence are the major management concerns. A subsurface drainage system is effective in removing excess water. Controlled drainage improves the stability of the soil and reduces the risk of subsidence. Field windbreaks, vegetative barriers, and cover crops help to control soil blowing. The use of equipment is restricted during wet periods.

This soil is poorly suited to pasture. Grazing when the soil is wet can destroy forage plants.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy planting and harvesting equipment is limited by wetness and by low soil strength. The equipment should be used only when the soil is frozen. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Windthrown trees should be periodically removed.

Because of wetness, this soil is unsuited to septic tank absorption fields and building site development. Better suited sites generally are available.

The land capability classification is IIIw. The woodland ordination symbol is 2W. The Michigan soil management group is M/mc.

13B—Selfridge-Capac complex, 0 to 5 percent slopes. These nearly level to undulating, somewhat poorly drained soils are on moraines and till plains. Individual areas are irregular in shape and range from 2 to 600 acres in size. They are 30 to 40 percent Selfridge soil and 30 to 40 percent Capac soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Selfridge soil has a surface layer of dark brown loamy sand about 14 inches thick. The subsoil is about 23 inches thick. It is mottled. The upper part is yellowish brown, very friable loamy sand, and the lower part is brown, firm loam. The underlying material to a depth of 60 inches is brown, mottled clay loam. In places the sandy material is more than 40 inches thick.

Typically, the Capac soil has a surface layer of very dark grayish brown loam about 10 inches thick. The subsurface layer is brown, mottled fine sandy loam about 3 inches thick. The subsoil is dark yellowish brown, mottled, firm clay loam about 9 inches thick. The underlying material to a depth of 60 inches is yellowish brown, mottled loam. In places sand is below a depth of 40 inches.

Included with these soils in mapping are small areas of Pipestone and Thetford soils. These included soils are sandy throughout. They are in landscape positions similar to those of the Selfridge and Capac soils. They make up 5 to 25 percent of the unit.

Permeability is rapid in the upper part of the Selfridge soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from late fall through spring and during excessively wet periods.

Permeability is moderately slow in the Capac soil, and the available water capacity is high. Surface runoff is medium.

Most areas are used as cropland. Some areas are used as pasture or woodland.

These soils are fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion, wetness, deterioration of tilth, and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops can reduce soil loss, improve tilth, help to prevent crusting after periods of heavy rainfall, and conserve moisture. Tilling during wet periods can result in the formation of clods, alteration of soil structure, and compaction. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. Suitable filtering material may be needed around tile lines to keep fine sand and silt from flowing into the lines. Stripcropping, vegetative barriers, and field windbreaks help to control soil blowing.

These soils are well suited to pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet and prolonged dry periods help to keep the pasture in good condition.

These soils are well suited to woodland. The major management concern is the equipment limitation. The use of equipment is restricted during wet periods, but the equipment can be used when the soils are relatively dry or frozen.

Because of wetness, these soils are poorly suited to building site development. A subsurface drainage system helps to lower the water table on building sites. Buildings can be constructed on suitable well compacted fill material, which raises the site. The soils are generally unsuited to septic tank absorption fields because of wetness and the moderately slow permeability. Filling or mounding with suitable material helps to raise the absorption field above the water table.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Selfridge soil is 6W, and that assigned to the Capac soil is 4W. The Michigan soil management groups are 4/2b and 2.5b.

14B—Dixboro loamy fine sand, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is in nearly flat areas, on slight rises, and in depressions on lake plains. Individual areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 11 inches thick. The subsurface layer is yellowish brown, mottled loamy very fine sand about 6 inches thick. The subsoil is about 12 inches of brown, mottled, friable very fine sandy loam that has strata of fine sand and very fine sand. The underlying material to a depth of 60 inches is yellowish brown, light brownish gray, and pale brown, mottled, stratified very fine sandy loam, fine sand, very fine sand, loamy very fine sand, and silty clay loam.

Included with this soil in mapping are small areas of the poorly drained Lamson soils in the slightly lower swales, in depressions, and in drainageways. These soils make up 2 to 5 percent of the unit.

Permeability is moderate in the Dixboro soil, and the available water capacity is high. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from late fall through spring and during excessively wet periods.

Most areas are used as cropland. Some areas are used as woodland or pasture.

This soil is well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are wetness, water erosion, deterioration of tilth, and soil blowing. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. Suitable filtering material may be needed around tile lines to keep fine sand and silt from flowing into the lines. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion and soil blowing, improve tilth, and help to prevent crusting after periods of heavy rainfall. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing. Tilling or harvesting during wet periods can result in the formation of clods, alteration of soil structure, and compaction.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing. Restricted grazing during wet periods helps to prevent compaction. The forage species that can tolerate wetness should be selected for planting.

Where this soil is used as woodland, the major

concern is the equipment limitation. Ruts can form if heavy equipment is used when the soil is wet. The equipment should be used only when the soil is relatively dry or frozen.

Because of wetness, this soil is poorly suited to building site development and is generally unsuited to septic tank absorption fields. A surface or subsurface drainage system helps to lower the water table on building sites. Buildings can be constructed on suitable well compacted fill material, which raises the site. Filling or mounding with suitable material helps to raise septic tank absorption fields above the water table.

The land capability classification is IIw. The woodland ordination symbol is 4W. The Michigan soil management group is 3b-s.

15B—Capac loam, 0 to 5 percent. This nearly level to undulating, somewhat poorly drained soil is in convex areas on low knolls and ridges and in depressions on till plains. Individual areas are irregular in shape and range from 2 to 70 acres in size.

Typically, the surface layer is very dark grayish brown loam about 10 inches thick. The next layer is brown, mottled fine sandy loam about 3 inches thick. The subsoil is dark yellowish brown, mottled, firm clay loam about 19 inches thick. The underlying material to a depth of 60 inches is yellowish brown, mottled loam. In some areas the soil is underlain by sand below a depth of 40 inches.

Included with this soil in mapping are small areas of the moderately well drained Marlette and somewhat poorly drained Selfridge soils. Marlette soils are on the slightly higher ridges and knolls. Selfridge soils are in landscape positions similar to those of the Capac soil. They have a sandy surface layer. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Capac soil, and the available water capacity is high. Surface runoff is medium. The seasonal high water table is at a depth of 1 to 2 feet from late fall through spring and during excessively wet periods.

Most areas are used as cropland. Some areas are used as woodland or pasture.

This soil is well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are wetness, water erosion, and deterioration of tilth. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. Suitable filtering material may be needed around tile lines to keep fine sand and silt from flowing into the lines. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion, improve tilth, and help to prevent crusting after periods of heavy rainfall. Tilling or harvesting during wet periods can result in the formation of clods, alteration of soil structure, and compaction.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion. Restricted grazing during wet periods helps to prevent surface compaction, excessive runoff, and damage to soil structure. The forage species that can tolerate wetness should be selected for planting.

Where this soil is used as woodland, the major management concern is the equipment limitation. Ruts can form if heavy equipment is used when the soil is wet. The equipment should be used only when the soil is relatively dry or frozen.

Because of wetness, this soil is poorly suited to building site development. It is generally unsuited to septic tank absorption fields because of wetness and the moderately slow permeability. A surface or subsurface drainage system helps to lower the water table on building sites. Buildings can be constructed on suitable well compacted fill material, which raises the site. Filling or mounding with suitable material helps to raise septic tank absorption fields above the water table.

The land capability classification is IIe. The woodland ordination symbol is 4W. The Michigan soil management group is 2.5b.

16—Napoleon peat. This nearly level, very poorly drained soil is in bogs on outwash plains (fig. 4). It is subject to ponding. Slope ranges from 0 to 2 percent. Individual areas are round, elongated, or irregularly shaped and range from 2 to 35 acres in size.

Typically, the surface layer is very dusky red peat about 5 inches thick. The subsurface layer is very dusky red, friable mucky peat about 19 inches thick. The underlying material to a depth of 60 inches is dusky red mucky peat.

Permeability is moderately slow to moderately rapid, and the available water capacity is very high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from early fall through late spring and during excessively wet periods.

Most areas support native vegetation, which consists of sphagnum moss and blueberries. This soil is generally unsuited to cultivated crops and pasture, mainly because of wetness and extreme acidity.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy harvesting equipment is limited by wetness and by low soil strength. The equipment should be used only when the soil is frozen. Because of

Figure 4.—Typical area of Napoleon peat. The conifers in the background are on a Plainfield sand.

wetness, severe seedling mortality, and plant competition, trees are not planted on this soil. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of wetness and low strength, this soil is unsuited to septic tank absorption fields and building site development.

The land capability classification is VIw. The woodland ordination symbol is 2W. The Michigan soil management group is Mc-a.

17B—Spinks-Metea-Coloma complex, 1 to 6 percent slopes. These nearly level to undulating soils are on moraines. Individual areas are irregular in shape and range from 2 to 310 acres in size. They are 30 to 35 percent well drained Spinks soil, 25 to 30 percent well drained Metea soil, and 15 to 25 percent excessively drained Coloma soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In places the subsoil is mottled.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Typically, the Coloma soil has a surface layer of black sand about 3 inches thick. The subsurface layer is

brown and yellow, friable and loose sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the soil has layers of fine sand. In other places it has no lamellae.

Included with these soils in mapping are small areas of Marlette, Toogood, and Scalley soils. Marlette soils are loamy throughout, Toogood soils have gravel in the lower part, and Scalley soils are loamy in the upper part. All of the included soils are in landscape positions similar to those of the Spinks, Metea, and Coloma soils. They make up 10 to 20 percent of the unit.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is slow.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Permeability is rapid in the Coloma soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. Some areas are used as cropland or pasture.

These soils are fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion, droughtiness, and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material can reduce soil loss and conserve moisture. Wind stripcropping, vegetative barriers, and field windbreaks help to control soil blowing.

These soils are well suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition.

Where these soils are used as woodland, the equipment limitation and seedling mortality are the major management concerns on the Coloma soil. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Planting containerized seedlings or larger than usual nursery stock, planting in furrows, and applying herbicides can reduce the seedling mortality rate.

These soils are well suited to building site development and fairly well suited to septic tank absorption fields. The Spinks soil is better suited to septic tank absorption fields than the Metea and Coloma soils. The moderately slow permeability in the lower part of the Metea soil is a limitation. The Coloma soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIIs. The woodland ordination symbol assigned to the Spinks and Metea soils is 4A, and that assigned to the Coloma soil is 2S. The Michigan soil management groups are 4a, 4/2a, and 5a.

17C—Spinks-Metea-Coloma complex, 6 to 12 percent slopes. These gently rolling soils are on moraines. Individual areas are irregular in shape and range from 2 to 140 acres in size. They are 20 to 30 percent well drained Spinks soil, 20 to 30 percent well drained Metea soil, and 20 to 30 percent excessively drained Coloma soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In places the subsoil has mottles.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Typically, the Coloma soil has a surface layer of black sand about 3 inches thick. The subsurface layer is brown and yellow, friable and loose sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the soil has layers of fine sand. In other places it has no lamellae.

Included with these soils in mapping are small areas of Toogood and Scalley soils. Toogood soils have gravel in the lower part, and Scalley soils are loamy in the upper part. Both of the included soils are in landscape positions similar to those of the Spinks, Metea, and Coloma soils. They make up 10 to 20 percent of the unit.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is slow.

Permeability is rapid in the upper part of the Metea

soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Permeability is rapid in the Coloma soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. Some areas are used as cropland or pasture.

These soils are fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion, droughtiness, and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material can reduce soil loss and conserve moisture. Wind stripcropping, vegetative barriers, and field windbreaks help to control soil blowing.

These soils are well suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition.

Where these soils are used as woodland, the equipment limitation and seedling mortality are the major management concerns on the Coloma soil. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Planting containerized seedlings or larger than usual nursery stock, planting in furrows, and applying herbicides can reduce the seedling mortality rate.

These soils are fairly well suited to building site development and septic tank absorption fields. The Spinks soil is better suited to septic tank absorption fields than the Metea and Coloma soils. The moderately slow permeability in the lower part of the Metea soil is a limitation. The Coloma soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water. The slope is the major management concern. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Spinks and Metea soils is 4A, and that assigned to the Coloma soil is 2S. The Michigan soil management groups are 4a, 4/2a, and 5a.

17D—Spinks-Metea complex, 12 to 25 percent slopes. These rolling and hilly, well drained soils are on moraines. Individual areas are irregular in shape and range from 2 to 80 acres in size. They are 35 to 50 percent Spinks soil and 30 to 40 percent Metea soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Included with these soils in mapping are small areas of the excessively drained Plainfield, well drained Scalley, and somewhat excessively drained Toogood soils. Plainfield soils have sand throughout and have no lamellae of loamy sand. Scalley soils are loamy in the upper part. Toogood soils have gravel in the lower part. All of the included soils are in landscape positions similar to those of the Spinks and Metea soils. They make up 10 to 20 percent of the unit.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is medium.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as woodland. Some areas are used as pasture.

These soils are unsuited to cropland. The slope, water erosion, droughtiness, and soil blowing are the major management concerns.

These soils are poorly suited to pasture. The slope, water erosion, soil blowing, and droughtiness are the major management concerns. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition.

Where these soils are used as woodland, the hazard of erosion and the equipment limitation are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Seeding logging roads, skid trails, and

landings after the trees are logged helps to prevent excessive erosion. Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Because of the slope, these soils are generally unsuited to building site development and septic tank absorption fields. Better suited sites generally are nearby.

The land capability classification is VIe. The woodland ordination symbol is 4R. The Michigan soil management groups are 4a and 4/2a.

19B—Covert sand, 0 to 4 percent slopes. This nearly level and very gently sloping, moderately well drained soil is on flats and in slight depressions on outwash plains and moraines. Individual areas are irregular in shape and range from 3 to 215 acres in size.

Black, well decomposed forest litter about 4 inches thick is on the surface. Typically, the surface layer is pinkish gray sand about 4 inches thick. The subsoil is about 20 inches of dark brown, very friable sand that has a few chunks of dark reddish brown, brittle material. The underlying material to a depth of 60 inches is light yellowish brown, mottled sand. In some areas the soil is not mottled in the underlying material. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Included with this soil in mapping are small areas of Kingsville, Pipestone, and Thetford soils. Kingsville soils are poorly drained and are in drainageways and depressions. Pipestone and Thetford soils are somewhat poorly drained and are in depressions. Included soils make up 2 to 15 percent of the unit.

Permeability is rapid in the Covert soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 2.0 to 3.5 feet from late fall through spring and during excessively wet periods.

Most areas are used as woodland or are left idle. A few areas are used as pasture or cropland.

This soil is poorly suited to corn, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are droughtiness and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material increase the available water capacity and reduce the susceptibility to soil blowing. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing. Growing small grain crops that are planted in fall or early in spring makes good use of the limited amount of available soil moisture.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the seasonal high water table, this soil is poorly suited to building site development. Buildings with basements can be constructed on suitable well compacted fill material, which raises the site. A drainage system lowers the water table. Because of the water table and a poor filtering capacity, the soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water. Special construction methods, such as filling or mounding with suitable material, may be needed to raise the site above the water table.

The land capability classification is IVs. The woodland ordination symbol is 4S. The Michigan soil management group is 5a.

20—Granby mucky sand. This nearly level, poorly drained soil is in drainageways and low areas on lake plains and outwash plains. Slope ranges from 0 to 2 percent. Individual areas are irregular in shape and range from 3 to 530 acres in size.

Typically, the surface layer is black mucky sand about 10 inches thick. The subsoil is pale brown, very friable sand about 14 inches thick. The underlying material to a depth of 60 inches is yellowish brown and pale brown, mottled fine sand and sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soils on slight rises and small areas of Jebavy soils. Jebavy soils have a cemented subsoil. They are in scattered areas throughout the unit. Included soils make up 3 to 15 percent of the unit.

Permeability is rapid in the Granby soil, and the available water capacity is low. Surface runoff is very

slow. The seasonal high water table is near or above the surface from late fall through late spring and during excessively wet periods.

Most areas are used as cropland or pasture or are left idle. Some areas are used as woodland.

If drained, this soil is poorly suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are droughtiness, soil blowing, and wetness. A subsurface drainage system is effective in removing excess water, but drainage outlets are not readily available in some areas. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control soil blowing and increase the available water capacity during dry periods. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing. The soil can be used for specialty crops, such as blueberries, carrots, and onions, but a drainage system is needed during wet periods and irrigation is needed during dry periods.

This soil is fairly well suited to pasture. If possible, a surface drainage system should be installed to reduce the wetness. The forage species that can tolerate the wetness should be selected for planting. Proper stocking rates, pasture rotation, and restricted use during excessively wet or dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

Because of wetness, this soil is generally unsuited to septic tank absorption fields and building site development. Better suited sites generally are available.

The land capability classification is IVw. The woodland ordination symbol is 2W. The Michigan soil management group is 5c.

21—Kingsville mucky sand. This nearly level, poorly drained soil is in drainageways and low areas on lake plains and outwash plains. Slope ranges from 0 to 2 percent. Individual areas are irregular in shape and range from 3 to 800 acres in size.

Typically, the surface layer is black mucky sand about 7 inches thick. The subsoil is pale brown, loose sand about 28 inches thick. The underlying material to a depth of 60 inches is brown sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soils on slight rises and small areas of Jebavy soils. Jebavy soils have a cemented subsoil. They are in scattered areas throughout the unit. Included soils make up 3 to 15 percent of the unit.

Permeability is rapid in the Kingsville soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is near or above the surface from late fall through spring and during excessively wet periods.

Most areas are used as woodland.

Because of wetness, this soil is not suited to cropland. Overcoming the wetness generally is not practical.

This soil is poorly suited to pasture. If possible, a surface drainage system should be installed to reduce the wetness. The forage species that can tolerate the wetness should be selected for planting. Proper stocking rates, pasture rotation, and restricted grazing during wet periods are needed.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Planting containerized seedlings or larger than usual nursery stock and planting on the ridges of furrows can reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

Because of wetness, this soil is generally unsuited to septic tank absorption fields and building site development. Better suited sites generally are available.

The land capability classification is Vw. The woodland ordination symbol is 5W. The Michigan soil management group is 5c.

22B—Scalley loam, 1 to 6 percent slopes. This nearly level to undulating, well drained soil is on low knolls and ridges on moraines. Individual areas are irregular in shape and range from 3 to 150 acres in size.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is firm clay loam about 29 inches thick. The upper part is dark brown and brown, and the lower part is dark brown. The underlying material to a depth of 60 inches is stratified brown and reddish yellow fine sand. In places depth to the sandy material is more than 40 inches.

Included with this soil in mapping are small areas of Metea soils and the somewhat poorly drained Capac soils. Capac soils are loamy throughout. They are in narrow drainageways and depressions. Metea soils are sandy in the upper part and loamy in the lower part.

They are in landscape positions similar to those of the Scalley soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the upper part of the Scalley soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as cropland. Some areas are used for pasture, woodland, or building site development.

This soil is well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion and deterioration of tilth. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion and maintain tilth. The soil tends to puddle and crust after heavy rains. Tillage or harvesting during wet periods can result in the formation of clods, alteration of soil structure, and compaction.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion.

No major hazards or limitations affect the use of this soil as woodland.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity in the sandy underlying material. The sandy material readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIe. The woodland ordination symbol is 3A. The Michigan soil management group is 3/5a.

22C—Scalley loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and ridges on moraines. Individual areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is firm clay loam about 29 inches thick. The upper part is dark brown and brown, and the lower part is dark brown. The underlying material to a depth of 60 inches is stratified brown and reddish yellow fine sand. In places depth to the sandy material is more than 40 inches.

Included with this soil in mapping are small areas of Metea soils and the somewhat poorly drained Capac soils. Capac soils are loamy throughout. They are in narrow drainageways and depressions. Metea soils have sandy material in the upper part and loamy material in the lower part. They are in landscape positions similar to those of the Scalley soil. Included soils make up 2 to 10 percent of the unit.

Permeability is moderately slow in the upper part of the Scalley soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as cropland. Some areas are used for pasture, woodland, or building site development.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion and deterioration of tilth. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to slow runoff, control water erosion, and improve tilth. Where possible, contour farming also can help to slow runoff and control water erosion. In the lower areas, where water tends to pond after heavy rains, crusting is a problem. Tillage or harvesting during wet periods can result in the formation of clods, alteration of soil structure, and compaction.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The sandy material readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of the ground water.

The land capability classification is IIIe. The woodland ordination symbol is 3A. The Michigan soil management group is 3/5a.

22D—Scalley loam, 12 to 18 percent slopes. This rolling, well drained soil is on knolls, ridges, and breaks to streams and drainageways on moraines. Individual areas are irregularly shaped or elongated and range from 2 to 25 acres in size.

Typically, the surface layer is dark brown loam about 7 inches thick. The subsoil is firm clay loam about 29 inches thick. The upper part is dark brown and brown, and the lower part is dark brown. The underlying material to a depth of 60 inches is stratified brown and reddish yellow fine sand. In places depth to the sandy material is more than 40 inches.

Included with this soil in mapping are small areas of Metea soils. These soils are sandy in the upper part

and loamy in the lower part. They are in landscape positions similar to those of the Scalley soil. They make up 2 to 10 percent of the unit.

Permeability is moderately slow in the upper part of the Scalley soil and rapid in the lower part. The available water capacity is moderate. Surface runoff is rapid.

Most areas are used as woodland or pasture. Some areas are used as cropland.

This soil is poorly suited to most crops, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are water erosion, deterioration of tilth, and the equipment limitation caused by the slope. Cover crops, green manure crops, and contour farming, where possible, help to slow runoff. A system of conservation tillage that does not invert the soil and that leaves all or part of the crop residue on the surface helps to slow runoff, control water erosion, and improve tilth. Tillage or harvesting during wet periods can result in the formation of clods, alteration of soil structure, and compaction.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in slowing runoff and controlling water erosion. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is generally unsuited to septic tank absorption fields and building site development.

The land capability classification is IVe. The woodland ordination symbol is 3A. The Michigan soil management group is 3/5a.

23—Lamson loamy fine sand. This poorly drained, nearly level soil is in depressions on lake plains. Slope ranges from 0 to 2 percent. Individual areas range from 3 to 75 acres in size.

Typically, the surface layer is black loamy fine sand about 9 inches thick. The next 4 inches is light brownish gray, mottled, loose sand that has thin strata of fine sandy loam. The next 13 inches is grayish brown, mottled, firm very fine sandy loam that has thin strata of sand. The underlying material to a depth of 60 inches is grayish brown, mottled, very friable, calcareous, stratified fine sand and loamy very fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Dixboro soils on slight rises. These soils make up 2 to 5 percent of the unit.

Permeability and the available water capacity are moderate in the Lamson soil. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late fall through spring and during other excessively wet periods.

Most areas are used as woodland. Some areas are used as cropland or are left idle.

If drained, this soil can be used for such crops as corn and hay, and for specialty crops, such as onions and carrots. Wetness, soil blowing, and deterioration of tilth are the major management concerns. A subsurface drainage system is effective in removing excess water. Draining many areas is difficult, however, because outlets are not readily available. Suitable filtering material may be needed around tile lines to keep sand and silt from flowing into the lines. Tilling when the soil is too wet can alter soil structure and can result in compaction. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control soil blowing and improve tilth. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

This soil is poorly suited to pasture. If drainage outlets are available, a surface drainage system can help to remove excess water. Restricted grazing during wet periods helps to keep the pasture in good condition. The forage species that can tolerate wetness should be selected for planting.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Equipment should be used only when the soil is relatively dry or frozen. When the soil is wet, logging roads tend to become slippery and ruts form quickly. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

Because of wetness, this soil is generally unsuited to building site development and septic tank absorption fields. Better suited sites generally are available.

The land capability classification is Vw. The woodland ordination symbol is 8W. The Michigan soil management group is 3c-s.

24—Edwards muck. This nearly level, very poorly drained soil is on low, broad flats and in depressions on outwash plains and lake plains. Slope ranges from 0 to 2 percent. Individual areas are irregular in shape and range from 2 to 86 acres in size.

Typically, the surface layer is black muck about 21 inches thick. The underlying layers to a depth of 60 inches are dark gray and olive gray marl.

Included with this soil in mapping are small areas of Adrian and Martisco soils. Adrian soils are underlain by sand. Martisco soils have less than 16 inches of muck and are underlain by marl. Both of the included soils are

in landscape positions similar to those of the Edwards soil. They make up as much as 5 percent of the unit.

Permeability is moderately slow to moderately rapid in the upper part of the Edwards soil and slow in the underlying marl. The available water capacity is moderate. Runoff is very slow or ponded. The seasonal high water table is at or above the surface from early fall through late spring and during excessively wet periods.

Most areas are used as cropland. Many areas are used for vegetable crops. Some areas are used as pasture or support native vegetation.

This soil is poorly suited to most crops. If the soil is drained, such crops as corn, carrots, celery, onions, and peppers can be grown. Wetness, soil blowing, and subsidence are the major management concerns. A subsurface drainage system is effective in removing excess water. In some areas draining the soil is difficult because drainage outlets are not readily available. Controlled drainage helps to prevent excessive soil blowing and subsidence. Field windbreaks, buffer strips, and cover crops help to control soil blowing. The use of equipment is restricted during wet periods. A subsurface drainage system may not be economically feasible if the organic material is shallow.

This soil is poorly suited to pasture. Grazing when the soil is wet can destroy forage plants.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy harvesting equipment is limited by wetness and by low soil strength. The equipment should be used only when the soil is frozen. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Windthrown trees should be periodically removed.

Because of wetness and low strength, this soil is unsuited to septic tank absorption fields and building site development. Better suited sites generally are available.

The land capability classification is IVw. The woodland ordination symbol is 2W. The Michigan soil management group is M/mc.

27—Granby mucky sand, gravelly substratum. This nearly level, poorly drained soil is in low areas on outwash plains and in glacial drainageways. Slope ranges from 0 to 2 percent. Individual areas are irregular in shape and range from 3 to 220 acres in size.

Typically, the surface layer is black mucky sand about 13 inches thick. The next 27 inches is stratified brown and pale brown, loose loamy sand and coarse sand. The underlying material to a depth of 60 inches is light yellowish brown gravelly loamy sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Watseka soils on slight rises and small areas of Kingsville soils. Kingsville soils do not have a gravelly calcareous layer in the lower part. They are in scattered areas throughout the unit. Included soils make up 3 to 5 percent of the unit.

Permeability is rapid in the Granby soil, and the available water capacity is low. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late fall through late spring and during excessively wet periods.

Most areas are used as woodland.

This soil is unsuited to cropland because of wetness. Overcoming the wetness generally is not practical.

This soil is poorly suited to pasture. If possible, a surface drainage system should be installed to reduce the wetness. The forage species that can tolerate the wetness should be selected for planting. Proper stocking rates, pasture rotation, and restricted grazing during wet periods are needed.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Planting containerized seedlings or larger than usual nursery stock and planting on the ridges of furrows can reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

Because of wetness, this soil is generally unsuited to septic tank absorption fields and building site development. Better suited sites generally are available.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is 5c.

28B—Watseka loamy sand, 0 to 4 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is on low knolls and ridges on outwash plains. Individual areas are irregular in shape and range from 2 to 105 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 14 inches thick. The subsoil is strong brown and very pale brown, mottled, very friable, loose sand about 27 inches thick. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand. In places the underlying material does not contain gravel.

Included with this soil in mapping are small areas of the poorly drained Granby soils that have a gravelly

substratum. These soils are in slight depressions. They make up less than 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Watseka soil and very rapid in the lower part. The available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 1 to 2 feet from late fall through spring and during excessively wet periods.

Most areas are used as woodland or are left idle. A few areas are used as pasture or cropland.

This soil is poorly suited to corn, but such crops as winter wheat and oats can be grown. The major management concerns are droughtiness, soil blowing, and wetness. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface can help to control soil blowing and conserve moisture. Growing cover crops and green manure crops and regularly adding organic material to the soil increase the available water capacity and help to control soil blowing. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during excessively wet or dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation is a management concern. Ruts can form if heavy equipment is used during wet periods. The equipment should be used only when the soil is relatively dry or frozen.

Because of wetness, this soil is poorly suited to building site development and septic tank absorption fields. A surface or subsurface drainage system helps to lower the water table on building sites. Buildings can be constructed on suitable well compacted fill material, which raises the site. Sanitary facilities should be connected to municipal sewage systems. Sites that are better suited to septic systems generally are available.

The land capability classification is IIIs. The woodland ordination symbol is 6W. The Michigan soil management group is 4b.

29B—Coloma sand, 0 to 6 percent slopes. This nearly level to undulating, excessively drained soil is on outwash plains. Individual areas are irregular in shape and range from 2 to 600 acres in size.

Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the subsoil has no lamellae. In other places the total thickness of the lamellae of loamy sand is more than 6 inches. In some areas the soil is fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Thetford, well drained Metea, and somewhat excessively drained or moderately well drained Toogood soils. Thetford soils are in slight depressions and in drainageways. Metea and Toogood soils are in landscape positions similar to those of the Coloma soil. Metea soils are loamy in the lower part of the subsoil and are less droughty than the Coloma soil. Toogood soils have gravel in the lower part. Included soils make up as much as 10 percent of the unit.

Permeability is rapid in the Coloma soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland or are planted to pine. Some areas are left idle or are used as cropland.

This soil is poorly suited to corn, but such crops as wheat, oats, hay, and asparagus can be grown. The major management concerns are droughtiness and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material increase the available water capacity and reduce the susceptibility to soil blowing. Vegetative barriers and field windbreaks also help to control soil blowing. Growing small grain crops that are planted in fall or early spring makes good use of the limited amount of available soil moisture.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is well suited to building site development, but it is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol is 2S. The Michigan soil management group is 5a.

29C—Coloma sand, 6 to 12 percent slopes. This gently rolling, excessively drained soil is on knolls and ridges on outwash plains. Individual areas are irregular in shape and range from 3 to 700 acres in size.

Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the subsoil has no lamellae. In other places the total thickness of the lamellae of loamy sand is more than 6 inches. In some areas the soil is fine sand.

Included with this soil in mapping are small areas of the well drained Metea soils on the tops of knolls and ridges. These soils are loamy in the lower part of the subsoil and are less droughty than the Coloma soil. Also included are small areas of Toogood soils. These soils have gravel in the lower part. They are in landscape positions similar to those of the Coloma soil. Included soils make up less than 10 percent of the unit.

Permeability is rapid in the Coloma soil, and the available water capacity is low. Surface runoff is slow.

Most areas are used as woodland or are planted to pine. Some areas are used as cropland or are left idle.

This soil is poorly suited to corn, but such crops as wheat, oats, hay, and asparagus can be grown. The major management concerns are droughtiness and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material increase the available water capacity and reduce the susceptibility to soil blowing. Vegetative barriers and field windbreaks also help to control soil blowing. Growing small grain crops that are planted in fall or early spring makes good use of the limited amount of available soil moisture.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is fairly well suited to building site development and poorly suited to septic tank absorption fields. The slope is a limitation on building sites, and the slope and a poor filtering capacity are limitations on sites for septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol is 2S. The Michigan soil management group is 5a.

29D—Coloma sand, 12 to 30 percent slopes. This rolling and hilly, excessively drained soil is on ridges and knolls on outwash plains and moraines. Individual areas are irregular in shape and range from 2 to 55 acres in size.

Typically, the surface layer is black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In places the soil has no lamellae.

Included with this soil in mapping are small areas of the well drained Metea soils. These soils are in landscape positions similar to those of the Coloma soil. They are loamy in the lower part of the subsoil and are less droughty than the Coloma soil. They make up 2 to 5 percent of the unit.

Permeability is rapid in the Coloma soil, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. This soil is unsuited to cropland and pasture, mainly because of the slope, droughtiness, and the hazards of water erosion and soil blowing.

Where this soil is used as woodland, the hazard of erosion, the equipment limitation, and seedling mortality are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. The slope limits the use of equipment. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Because of droughtiness,

loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol is 2S. The Michigan soil management group is 5a.

32—Carlisle muck. This nearly level, very poorly drained soil is in depressions on till plains, outwash plains, and moraines. Slope ranges from 0 to 2 percent. Individual areas are irregularly shaped or oval and range from 2 to 110 acres in size.

Typically, the surface layer is black muck about 18 inches thick. The underlying layers to a depth of 60 inches are black and very dark brown muck.

Included with this soil in mapping are small areas of the very poorly drained Adrian and Linwood soils. These soils are in landscape positions similar to those of the Carlisle soil. Adrian soils have sand in the underlying layers, and Linwood soils have loam in the underlying layers. Included soils make up 2 to 5 percent of the unit.

Permeability is moderately slow to moderately rapid in the Carlisle soil, and the available water capacity is very high. Surface runoff is very slow. The seasonal high water table is near or above the surface from early fall through late spring and during excessively wet periods.

Most areas are used as woodland. Some areas are used as cropland.

If drained, this soil is fairly well suited to such crops as corn, carrots, celery, and onions (fig. 5). Wetness, soil blowing, and subsidence are the major management concerns. A subsurface drainage system or open ditches help to remove excess water. Draining many areas is difficult, however, because drainage outlets are not readily available. Controlled drainage improves the stability of the soil and reduces the extent of subsidence. Wind stripcropping, windbreaks, and cover crops help to control soil blowing. The use of equipment is limited during wet periods.

This soil is poorly suited to pasture. Grazing when the soil is wet can destroy forage plants.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy harvesting equipment is limited by wetness and by low soil strength. The equipment should be used only when the soil is frozen. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Windthrown trees should be periodically removed.

Because of wetness and low strength, this soil is unsuited to septic tank absorption fields and building site development. Better suited sites generally are available.

The land capability classification is IIIw. The woodland ordination symbol is 2W. The Michigan soil management group is Mc.

36B—Del Rey loam, 0 to 4 percent slopes. This somewhat poorly drained, nearly level and gently undulating soil is in depressions on lake plains. Individual areas range from 2 to 300 acres in size.

Typically, the surface layer is dark brown loam about 11 inches thick. The subsurface layer is light brownish gray and brown, mottled loam about 4 inches thick. The subsoil is about 9 inches of dark yellowish brown and yellowish brown, mottled, firm silty clay loam and very fine sandy loam. The underlying material to a depth of 60 inches is brown, mottled silty clay loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Cosad soils and the well drained Perrinton and Tustin soils. Cosad and Tustin soils are sandy in the upper part. Cosad soils are in landscape positions similar to those of the Del Rey soil. Perrinton and Tustin soils are on the slightly higher rises. Included soils make up 5 to 15 percent of the unit.

Permeability is slow in the Del Rey soil, and the available water capacity is moderate. Surface runoff is slow or medium. The seasonal high water table is at a depth of 1 to 2 feet from late fall through spring and during excessively wet periods.

Most areas are used as cropland or woodland. Some areas are used as pasture or are left idle.

This soil is well suited to such crops as corn, winter wheat, hay, and oats (fig. 6). The major management concerns are wetness, water erosion, and deterioration of tilth. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. Suitable filtering material may be needed around tile lines to keep fine sand and silt from flowing into the lines. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion and improve tilth. The soil tends to puddle and crust after heavy rains. Tillage or harvesting when the soil is too wet can result in the formation of clods, alteration of soil structure, and compaction.

Figure 5.—Celery in an area of Carlisle muck.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling erosion. Restricted grazing during wet periods helps to prevent compaction and helps to keep the pasture in good condition. The forage species that can tolerate wetness should be selected for planting.

Where this soil is used as woodland, the major management concerns are the equipment limitation, seedling mortality, and the hazard of windthrow. Ruts can form if heavy equipment is used when the soil is wet. The equipment should be used only when the soil is relatively dry or frozen. Special site preparation, such as bedding, is needed in some areas to increase the seedling survival rate. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of wetness, this soil is poorly suited to building site development. It is generally unsuited to septic tank absorption fields because of wetness and the slow permeability. Buildings can be constructed on suitable well compacted fill material, which raises the site. A surface or subsurface drainage system helps to lower the water table on building sites. All sanitary facilities should be connected to municipal sewage systems.

The land capability classification is IIe. The woodland ordination symbol is 3C. The Michigan soil management group is 1.5b.

39B—Boyer loamy sand, 0 to 6 percent slopes. This nearly level to gently sloping, well drained soil is on outwash plains and terraces. Individual areas are irregular in shape and range from 2 to 550 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, very friable loamy sand. The lower part is reddish brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand. In some places the soil has no gravel. In other places it has bright mottles in the lower part. In a few areas it does not have a layer of gravelly sandy loam.

Included with this soil in mapping are small areas of the well drained Spinks and excessively drained Plainfield and Coloma soils. All of the included soils are sandy throughout. They are in landscape positions similar to those of the Boyer soil. They make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. The available water capacity is low. Surface runoff is very slow.

Most areas are used as cropland, pasture, or woodland or are left idle. Some areas are used as building sites. Gravel pits are in many areas.

This soil is fairly well suited to such crops as corn, oats, winter wheat, and hay. Droughtiness and soil blowing are the major management concerns. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and additions of organic material increase the available water capacity and help to control soil blowing. Vegetative barriers, wind stripcropping, and field windbreaks also help to control soil blowing. Growing small grain that is seeded in the fall or spring makes good use of the limited amount of available soil moisture.

This soil is well suited to pasture. Droughtiness is the main management concern. Because plant growth is limited by the droughtiness, pasture rotation and proper stocking rates are needed to protect forage species. During the dry summer months, the pasture should not be used or should be rotated more frequently.

No major hazards or limitations affect the use of this soil as woodland.

Figure 6.—Hay in an area of Del Rey loam, 0 to 4 percent slopes. This soil is well suited to hay.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIIs. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

39C—Boyer loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and ridges on outwash plains. Individual areas are irregular in shape and range from 2 to 65 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, very friable loamy sand. The lower part is reddish brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand. In some places the soil has no gravel. In other places it has bright mottles in the lower part. In a few areas it does not have a layer of gravelly sandy loam.

Included with this soil in mapping are small areas of the well drained Spinks and excessively drained Coloma soils. These soils are sandy throughout. They are in landscape positions similar to those of the Boyer soil. They make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. The available water capacity is low. Surface runoff is slow.

Most areas are used as cropland or woodland or are left idle. Some areas are used as building sites or pasture. Gravel pits are in many areas.

This soil is fairly well suited to such crops as corn, oats, winter wheat, and hay. Droughtiness, water erosion, and soil blowing are the major management concerns. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material increase the available water capacity and help to control water erosion and soil blowing. Vegetative barriers, wind stripcropping, and field windbreaks also help to control soil blowing. Growing small grain that is seeded in the fall or spring makes good use of the limited amount of available soil moisture.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing. Droughtiness is the main management concern. Because plant growth is limited by the droughtiness, pasture rotation and proper stocking rates are needed to protect forage species. During the dry summer months, the pasture should not be used or should be rotated more frequently.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

39D—Boyer loamy sand, 12 to 18 percent slopes. This rolling, well drained soil is on knolls, ridges, and the side slopes of breaks to streams and drainageways on outwash plains. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, very friable loamy sand. The lower part is reddish brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand. In places the soil has no gravel. In a few areas it does not have a layer of gravelly sandy loam.

Included with this soil in mapping are small areas of the well drained Spinks soils. These soils are in landscape positions similar to those of the Boyer soil. They make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Boyer soil and very rapid in the lower part. The available water capacity is low. Surface runoff is medium.

Most areas are used as woodland or are left idle. A few areas are used as cropland, building sites, or pasture. Gravel pits are in many areas.

This soil is poorly suited to corn, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are water erosion, soil blowing, and the equipment limitation caused by the slope. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control erosion and soil blowing and increase the available water capacity. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing. In areas where it is feasible, contour farming

can help to control erosion. Growing small grain that is seeded in the fall or spring makes good use of the limited amount of available soil moisture.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing. Droughtiness is the main management concern. Because plant growth is limited by the droughtiness, pasture rotation and proper stocking rates are needed to protect forage species. During the dry summer months, the pasture should not be used or should be rotated more frequently.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is poorly suited to building site development. It is poorly suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so they conform to the natural slope of the land. In many areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

39E—Boyer loamy sand, 18 to 40 percent slopes. This moderately steep and steep, well drained soil is on knolls, ridges, and the side slopes of breaks to streams and drainageways on outwash plains. Individual areas are irregular in shape and range from 2 to 20 acres in size.

Typically, the surface layer is dark brown loamy sand about 10 inches thick. The subsoil is about 20 inches thick. The upper part is dark brown, very friable loamy sand. The lower part is reddish brown, friable gravelly sandy loam. The underlying material to a depth of 60 inches is yellowish brown gravelly coarse sand. In places the soil has no gravel. In a few areas it does not have a layer of gravelly sandy loam.

Permeability is moderately rapid in the upper part of the soil and very rapid in the lower part. The available water capacity is low. Surface runoff is rapid.

Most areas are used as woodland or are left idle. Gravel pits are in many areas. This soil is unsuited to cultivated crops and pasture because of the slope.

Where this soil is used as woodland, the major management concerns are the hazard of erosion and the equipment limitation. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Trees cannot be easily harvested on this soil. Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Because of the slope, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management group is 4a.

40B—Tustin loamy sand, 1 to 6 percent slopes. This nearly level to undulating, well drained soil is on the tops and side slopes of knolls and ridges on lake plains. Individual areas are irregular in shape and range from 2 to 210 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 6 inches thick. The subsurface layer is light brown loamy sand about 1 inch thick. The upper part of the subsoil is strong brown, very friable loamy sand about 14 inches thick. The lower part is brown, firm silty clay loam about 15 inches thick. The underlying material to a depth of 60 inches is brown, mottled silty clay loam. In some places the soil has a mottled subsoil. In other places the sandy material is more than 40 inches thick.

Included with this soil in mapping are small areas of the somewhat poorly drained Cosad soils and the well drained Spinks and Perrinton soils. Perrinton soils are loamy throughout. They are on the side slopes of drainageways and depressions or in landscape positions similar to those of the Tustin soil. Cosad soils are in depressions. Spinks soils are sandy throughout. They are on the tops of some knolls and ridges. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of the Tustin soil and slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as cropland. Some areas are used as pasture or are left idle.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material help to control soil blowing and water erosion and increase the available water capacity. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion.

No major hazards or limitations affect the use of this soil as woodland.

Because of the shrink-swell potential, this soil is only fairly well suited to buildings with basements. Widening the foundation trenches and then backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Subsurface drains also help to prevent this damage. The soil is poorly suited to septic tank absorption fields because of the slow permeability. Mounding with suitable material and enlarging or pressurizing the absorption field or installing alternating drain fields help to overcome the slow permeability.

The land capability classification is IIIe. The woodland ordination symbol is 3A. The Michigan soil management group is 4/1a.

40C—Tustin loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on the tops and side slopes of knolls and ridges on lake plains. Individual areas are irregular in shape and range from 2 to 100 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 6 inches thick. The subsurface layer is light brown loamy sand about 1 inch thick. The upper part of the subsoil is strong brown, very friable loamy sand about 14 inches thick. The lower part is brown, firm silty clay loam about 15 inches thick. The underlying material to a depth of 60 inches is brown, mottled silty clay loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Included with this soil in mapping are small areas of the well drained Spinks and Perrinton soils. Perrinton soils are loamy throughout. They are on the side slopes of drainageways and depressions or in landscape positions similar to those of the Tustin soil. Spinks soils are sandy throughout. They are on the tops of some knolls and ridges. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Tustin soil and slow in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as cropland. Some areas are used as pasture or woodland or are left idle.

This soil is poorly suited to corn, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are water erosion and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material help to control soil blowing and water erosion and increase the available water capacity. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion.

No major hazards or limitations affect the use of this soil as woodland.

Because of the shrink-swell potential and the slope, this soil is only fairly well suited to buildings with basements. Widening the foundation trenches and then backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Subsurface drains also help to prevent this damage. The buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in some areas. The soil is generally unsuited to septic tank absorption fields because of the slow permeability. Filling with suitable material and pressurizing the absorption field help to overcome the slow permeability. Land shaping and installing the distribution lines on the contour help to overcome the slope.

The land capability classification is IVe. The woodland ordination symbol is 3A. The Michigan soil management group is 4/1a.

41B—Marlette loam, moderately wet, 1 to 6 percent slopes. This nearly level to undulating, moderately well drained soil is on low knolls and ridges on till plains. Individual areas are irregular in shape and range from 2 to 225 acres in size.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The next layer is brown and pale brown, mottled, friable loam about 8 inches thick. The subsoil is brown, mottled, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown, mottled loam. In some areas sand is below a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac and well drained Spinks soils. Capac soils are in narrow drainageways and in depressions. Spinks soils are droughtier than the Marlette soil and are sandy throughout. They are in landscape positions similar to those of the Marlette soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. The seasonal high water table is at a depth of 2.5 to 6.0 feet. Surface runoff is medium.

Most areas are used for cultivated crops or for orchards. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion and deterioration of tilth. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion and improve tilth. The soil tends to puddle and crust after heavy rains. Tillage or harvesting when the soil is too wet can alter soil structure and can result in compaction and the formation of clods.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion.

No major hazards or limitations affect the use of this soil as woodland.

Because wetness is a limitation on sites for buildings with basements, this soil is only fairly well suited to building site development. Buildings with basements can be constructed on suitable well compacted fill material, which raises the site. A drainage system can help to lower the water table. The soil is poorly suited to septic tank absorption fields because of the moderately slow permeability and the wetness. Special construction methods, such as enlarging the absorption fields or installing alternating drain fields, can help to overcome the wetness and the restricted permeability.

The land capability classification is IIe. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

41C—Marlette loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and ridges on till plains and moraines. Individual areas are irregular in shape and range from 2 to 1,000 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The next layer is brown and pale brown, friable loam about 8 inches thick. The subsoil is brown, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some areas sand is below a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac soils and the well drained Metea, Scalley, and Spinks soils. Capac soils are in narrow drainageways and in depressions. Metea, Scalley, and Spinks soils are in landscape positions similar to those of the Marlette soil. Metea soils are sandy in the upper part. Scalley soils are sandy in the lower part. Spinks soils are droughtier than the Marlette soil and are sandy throughout. Included soils make up 2 to 15 percent of the unit.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is rapid.

Most areas are used for cultivated crops or for orchards. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion and deterioration of tilth. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to slow runoff, control water erosion, and improve tilth. In areas where it is feasible, contour farming also slows runoff and helps to control water erosion. In the lower areas, where water tends to pond after heavy rains, crusting is a problem. Tillage or harvesting when the soil is too wet can alter soil structure and can result in compaction and the formation of clods.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields because of the moderately slow permeability. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. Also, special construction methods, such as enlarging the absorption fields or installing alternating drain fields, are needed to overcome the moderately slow permeability.

The land capability classification is IIIe. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

41C2—Marlette loam, 6 to 12 percent slopes, eroded. This gently rolling, well drained soil is on knolls and ridges on till plains and moraines. Individual areas are irregular in shape and range from 2 to 60 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The next layer is brown and pale brown, friable loam about 2 inches thick. The subsoil is brown, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In places sand is below a depth of 40 inches. In some small areas erosion has exposed the subsoil.

Included with this soil in mapping are small areas of the somewhat poorly drained Capac and the well drained Metea, Scalley, and Spinks soils. Capac soils are in narrow drainageways and in depressions. Metea, Scalley, and Spinks soils are in landscape positions similar to those of the Marlette soil. Metea soils are

sandy in the upper part. Scalley soils are sandy in the lower part. Spinks soils are droughtier than the Marlette soil and are sandy throughout. Included soils make up 2 to 15 percent of the unit.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is rapid.

Most areas are used for cultivated crops or for orchards. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion and deterioration of tilth. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to slow runoff, control water erosion, and improve tilth. In areas where it is feasible, contour farming also slows runoff and helps to control water erosion. In the lower areas, where water tends to pond after heavy rains, crusting is a problem. Tillage or harvesting when the soil is too wet can alter soil structure and can result in compaction and the formation of clods.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is fairly well suited to building site development. It is poorly suited to septic tank absorption fields because of the moderately slow permeability. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. Also, special construction methods, such as enlarging the absorption fields or installing alternating drain fields, are needed to overcome the moderately slow permeability.

The land capability classification is IIIe. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

41D—Marlette loam, 12 to 18 percent slopes. This rolling, well drained soil is on knolls, ridges, and breaks to streams and drainageways on till plains and moraines. Individual areas are irregularly shaped or elongated and range from 2 to 30 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The next layer is brown and pale brown, friable loam about 8 inches thick. The subsoil is brown, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In places sand is below a depth of 40 inches. In some spots the soil is eroded.

Included with this soil in mapping are small areas of the well drained Spinks soils. These soils are in landscape positions similar to those of the Marlette soil. They are sandy and are droughtier than the Marlette soil. They make up 3 to 5 percent of the unit.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is rapid.

Most areas are used for orchards or pasture. Some areas are used as cropland or woodland.

This soil is poorly suited to corn, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are water erosion, deterioration of tilth, and the equipment limitation caused by the slope. Cover crops, green manure crops, and contour farming can help to slow runoff and control water erosion. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface helps to slow runoff, control water erosion, and improve tilth. Tilling and harvesting when the soil is too wet can alter soil structure and can result in compaction and the formation of clods. A permanent cover of vegetation, such as perennial grasses, helps to control runoff and water erosion in orchards.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in slowing runoff and controlling water erosion. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is poorly suited to building site development. It is poorly suited to septic tank absorption fields because of the slope and the moderately slow permeability. Buildings should be designed so they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. Also, special construction methods, such as enlarging the absorption fields, are needed to overcome the moderately slow permeability.

The land capability classification is IVe. The woodland ordination symbol is 3A. The Michigan soil management group is 2.5a.

42B—Metea-Marlette-Spinks complex, 1 to 6 percent slopes. These nearly level to undulating, well drained soils are on moraines. Individual areas are irregular in shape and range from 2 to 250 acres in size. They are 35 to 45 percent Metea soil, 30 to 40 percent Marlette soil, and 15 to 30 percent Spinks soil.

These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Typically, the Marlette soil has a surface layer of dark grayish brown loam about 10 inches thick. The next layer is brown and pale brown, mottled, friable loam about 8 inches thick. The subsoil is brown, mottled, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown, mottled loam. In some areas sand is below a depth of 40 inches.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In some areas the total thickness of the lamellae is less than 6 inches. In places the subsoil is mottled.

Included with these soils in mapping are small areas of the somewhat poorly drained Capac and well drained Scalley soils. Capac soils are loamy throughout. They are in drainageways and depressions. Scalley soils are loamy in the upper part and sandy in the lower part. They can occur anywhere in the unit, except for drainageways and depressions. Included soils make up 5 to 20 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is medium.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as cropland.

These soils are fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion, droughtiness, soil blowing, and deterioration of tilth. A system of conservation tillage that leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material can reduce soil loss and conserve moisture. Vegetative barriers and field windbreaks help to control soil blowing.

These soils are well suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Proper stocking rates, pasture rotation, and restricted grazing during excessively wet or dry periods help to keep the pasture in good condition.

No major hazards or limitations affect the use of these soils as woodland.

These soils are well suited to building site development. They are poorly suited to septic tank absorption fields because of the moderately slow permeability in the loamy subsoil. Special construction methods, such as enlarging the absorption fields or installing alternating drain fields, can help to overcome the restricted permeability.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Metea and Spinks soils is 4A, and that assigned to the Marlette soil is 3A. The Michigan soil management groups are 4/2a, 2.5a, and 4a.

42C—Metea-Marlette-Spinks complex, 6 to 12 percent slopes. These gently rolling, well drained soils are on moraines. Individual areas are irregular in shape and range from 2 to 130 acres in size. They are 30 to 40 percent Metea soil, 30 to 40 percent Marlette soil, and 20 to 35 percent Spinks soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the sandy material is more than 40 inches thick.

Typically, the Marlette soil has a surface layer of dark grayish brown loam about 10 inches thick. The next layer is brown and pale brown, friable loam about 8 inches thick. The subsoil is brown, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some areas sand is below a depth of 40 inches.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In some

Figure 7.—An orchard in an area of Metea-Marlette-Spinks complex, 6 to 12 percent slopes.

areas the total thickness of the lamellae is less than 6 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Capac and well drained Scalley soils. Capac soils are loamy throughout. They are in drainageways and depressions. Scalley soils are loamy in the upper part and sandy in the lower part. They can occur anywhere in the unit, except for drainageways and depressions. Included soils make up 3 to 15 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is rapid.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is slow.

Most areas are used as cropland (fig. 7). Some areas are used as woodland.

These soils are fairly well suited to such crops as corn, winter wheat, oats, and hay. Water erosion, droughtiness, soil blowing, and deterioration of tilth are the major management concerns. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion and soil blowing, conserve moisture, and improve tilth. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

These soils are well suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Proper stocking rates, pasture rotation, and restricted grazing during excessively wet or dry

periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of these soils as woodland.

Because of the slope, these soils are only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. The soils are poorly suited to septic tank absorption fields because of the slope and the moderately slow permeability in the loamy subsoil. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Special construction methods, such as enlarging the absorption fields or installing alternating drain fields, help to overcome the moderately slow permeability.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Metea and Spinks soils is 4A, and that assigned to the Marlette soil is 3A. The Michigan soil management groups are 4/2a, 2.5a, and 4a.

42C2—Metea-Marlette-Spinks complex, 6 to 12 percent slopes, eroded. These gently rolling, well drained soils are on moraines. Individual areas are irregular in shape and range from 3 to 80 acres in size. They are 30 to 40 percent Metea soil, 30 to 40 percent Marlette soil, and 20 to 35 percent Spinks soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 20 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the sandy material is more than 40 inches thick.

Typically, the Marlette soil has a surface layer of dark grayish brown loam about 10 inches thick. The next layer is brown and pale brown, friable loam about 4 inches thick. The subsoil is brown, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In places sand is below a depth of 40 inches. In some small areas erosion has exposed the subsoil.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 12 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In some areas the total thickness of the lamellae is less than 6 inches.

Included with these soils in mapping are small areas of the somewhat poorly drained Capac and well drained Scalley soils. Capac soils are loamy throughout. They are in drainageways and depressions. Scalley soils are loamy in the upper part and sandy in the lower part. They can occur anywhere in the unit, except for drainageways and depressions. Included soils make up 3 to 15 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is rapid.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is slow.

Most areas are used as cropland. Some areas are used as woodland.

These soils are fairly well suited to such crops as corn, winter wheat, oats, and hay. Water erosion, droughtiness, soil blowing, and deterioration of tilth are the major management concerns. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion and soil blowing, conserve moisture, and improve tilth. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

These soils are well suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Proper stocking rates, pasture rotation, and restricted grazing during excessively wet or dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of these soils as woodland.

Because of the slope, these soils are only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. The soils are poorly suited to septic tank absorption fields because of the moderately slow permeability in the loamy subsoil and the slope. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Special construction methods, such as enlarging the absorption fields or installing alternating drain fields, help to overcome the moderately slow permeability.

The land capability classification is IIIe. The

woodland ordination symbol assigned to the Metea and Spinks soils is 4A, and that assigned to the Marlette soil is 3A. The Michigan soil management groups are 4/2a, 2.5a, and 4a.

42D—Metea-Spinks-Marlette complex, 12 to 25 percent slopes. These rolling and hilly, well drained soils are on moraines. Individual areas are irregular in shape and range from 2 to 200 acres in size. They are 40 to 50 percent Metea soil, 20 to 30 percent Spinks soil, and 10 to 20 percent Marlette soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Metea soil has a surface layer of very dark grayish brown, very friable loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the sandy material is more than 40 inches thick.

Typically, the Spinks soil has a surface layer of dark brown, loose loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In some areas the total thickness of the lamellae is less than 6 inches.

Typically, the Marlette soil has a surface layer of dark grayish brown loam about 10 inches thick. The next layer is brown and pale brown, friable loam about 8 inches thick. The subsoil is brown, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some areas sand is below a depth of 40 inches. In many spots the soil is eroded.

Included with these soils in mapping are small areas of the well drained Scalley soils. These included soils are loamy in the upper part and sandy in the lower part. They can occur anywhere in the unit, except for drainageways and depressions. They make up 3 to 5 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is medium.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is medium.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is rapid.

Most areas are used as woodland or are left idle. Some areas are used as pasture.

These soils are unsuited to cultivated crops because of the hazard of water erosion and the equipment limitation caused by the slope. A permanent cover of vegetation, such as perennial grasses, helps to control runoff and water erosion in orchards.

These soils are poorly suited to pasture. A permanent cover of pasture plants is effective in controlling water erosion. Operating equipment on the contour can minimize the equipment limitation caused by the slope. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

Where these soils are used as woodland, the hazard of erosion and the equipment limitation are the main management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Because of the slope, these soils are generally unsuited to septic tank absorption fields and building site development.

The land capability classification is IVe. The woodland ordination symbol assigned to the Metea and Spinks soils is 4R and that assigned to the Marlette soil is 3R. The Michigan soil management groups are 4/2a, 4a, and 2.5a.

42E—Metea-Spinks complex, 25 to 40 percent slopes. These hilly and steep, well drained soils are on moraines. Individual areas are irregular in shape and range from 2 to 100 acres in size. They are 40 to 50 percent Metea soil and 40 to 50 percent Spinks soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the sandy material is more than 40 inches thick.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish

brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In some areas the total thickness of the lamellae is less than 6 inches.

Included with these soils in mapping are small areas of the well drained Marlette and excessively drained Plainfield soils. Marlette soils are loamy throughout. Plainfield soils are sandy throughout and do not have lamellae of loamy sand. Both of the included soils are in scattered areas throughout the unit. They make up 3 to 15 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is medium.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland or are left idle. Some areas are used as pasture. These soils are generally unsuited to cropland and pasture because of droughtiness, the slope, and the hazard of water erosion.

Where these soils are used as woodland, the hazard of erosion and the equipment limitation are the main management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. The slope limits the use of equipment. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Because of the slope, special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible.

Because of the slope, these soils are generally unsuited to septic tank absorption fields and building site development.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management groups are 4/2a and 4a.

43B—Metea loamy sand, 1 to 6 percent slopes. This nearly level to undulating, well drained soil is on the tops and convex side slopes of knolls and ridges on till plains and moraines. Individual areas are irregular in shape and range from 2 to 130 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick. In some areas the loamy subsoil is underlain by sand.

Included with this soil in mapping are small areas of Marlette, Selfridge, and Spinks soils. Marlette and Spinks soils are on the tops of some knolls and ridges. Marlette soils are loamy throughout. Spinks soils are sandy throughout. Selfridge soils are somewhat poorly drained and are in drainageways and low spots. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as cropland. Some areas are used for pasture or orchards.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. Water erosion, soil blowing, and droughtiness are the major management concerns. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material help to control water erosion and soil blowing and conserve moisture. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of this soil as woodland.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of the moderately slow permeability in the loamy subsoil and underlying material. Special construction methods, such as enlarging the absorption field or installing alternating drain fields, help to overcome this limitation.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 4/2a.

43C—Metea loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on the convex side slopes of knolls and ridges on till plains and moraines. Individual areas are irregular in shape and range from 2 to 340 acres in size.

Typically, the surface layer is very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable and

loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the sandy material is more than 40 inches thick. In other places the loamy subsoil is underlain by sand. In some areas the subsoil is mottled.

Included with this soil in mapping are small areas of Marlette, Selfridge, and Spinks soils. Marlette and Spinks soils are on the tops of some knolls and ridges. Marlette soils are loamy throughout. Spinks soils are sandy throughout. Selfridge soils are somewhat poorly drained and are in drainageways and low spots. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as cropland or pasture. Some areas are used for orchards or woodland.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. Water erosion, soil blowing, and droughtiness are the major management concerns. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material help to control water erosion and soil blowing and conserve moisture. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. The soil is poorly suited to septic tank absorption fields because of the slope and the moderately slow permeability in the loamy subsoil and underlying material. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Special construction methods, such as enlarging the absorption fields or installing alternating drain fields, help to overcome the moderately slow permeability.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 4/2a.

44B—Spinks loamy sand, 0 to 6 percent slopes. This nearly level to undulating, well drained soil is on knolls and ridges and in slightly convex areas on moraines. Individual areas are irregular in shape and range from 2 to 265 acres in size.

Typically, the surface layer is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In places the soil is dominantly fine sand. In some areas the total thickness of the lamellae is less than 6 inches. In other areas the subsoil is mottled.

Included with this soil in mapping are small areas of Brems and Metea soils. Brems soils are moderately well drained and are in drainageways and slight depressions. Metea soils are loamy in the lower part of the subsoil. They are on the tops of knolls and ridges. Included soils make up 2 to 15 percent of the unit.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland or cropland. Some areas are used for tree plantations.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are droughtiness and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, regular additions of other organic material, cover crops, and green manure crops increase the available water capacity and reduce the susceptibility to soil blowing. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of this soil as woodland.

This soil is well suited to building site development and septic tank absorption fields. No major management concerns affect these uses.

The land capability classification is IIIs. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

44C—Spinks loamy sand, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and ridges on moraines. Individual areas are irregular in shape and range from 2 to 175 acres in size.

Typically, the surface layer is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In places the soil is dominantly fine sand. In some areas the total thickness of the lamellae is less than 6 inches.

Included with this soil in mapping are small areas of the moderately well drained Brems and well drained Metea and Scalley soils. Brems soils are in drainageways and slight depressions. Metea soils are on low knolls and ridges. They are loamy in the lower part of the subsoil and are less permeable than the Spinks soil. Scalley soils are in scattered areas throughout the unit. They are loamy in the upper part. Included soils make up 2 to 10 percent of the unit.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is slow.

Most areas are used as woodland. Some areas are used as cropland.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are droughtiness, soil blowing, and water erosion. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material help to control water erosion and soil blowing and increase the available water capacity. Wind stripcropping, vegetative barriers, and windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is only fairly well suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

44D—Spinks loamy sand, 12 to 18 percent slopes. This rolling, well drained soil is on the convex side slopes of knolls and ridges on moraines. Individual areas are irregular in shape and range from 3 to 145 acres in size.

Typically, the surface layer is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In some areas the total thickness of the lamellae is less than 6 inches.

Included with this soil in mapping are small areas of the well drained Metea soils on knolls and ridges. These soils are loamy in the lower part of the subsoil and are less permeable than the Spinks soil. They make up 2 to 5 percent of the unit.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland.

This soil is poorly suited to corn, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are water erosion, soil blowing, droughtiness, and the equipment limitation caused by the slope. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface and regular additions of other organic material help to control water erosion and soil blowing and increase the available water capacity.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is poorly suited to building site development and septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is necessary in many areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 4a.

44E—Spinks loamy sand, 18 to 40 percent slopes. This hilly and steep, well drained soil is on the tops and sides of knolls and ridges on moraines. Individual areas

are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In some places the total thickness of the lamellae of loamy sand is less than 6 inches. In other places the subsoil has no lamellae.

Included with this soil in mapping are small areas of Metea soils on knolls and ridges. These soils are loamy in the lower part of the subsoil and are less permeable than the Spinks soil. They make up as much as 5 percent of the unit.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. Some areas are left idle. This soil is unsuited to cropland and pasture because of droughtiness, the slope, and the hazard of water erosion.

Where this soil is used as woodland, the hazard of erosion and the equipment limitation are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Seeding logging roads, skid trails, and landings after the trees are logged helps to prevent excessive erosion. The slope limits the use of equipment. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Special care is needed in laying out logging roads and landings and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible. Because of the slope, hand planting may be necessary.

Because of the slope, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management group is 4a.

46B—Perrinton loam, 1 to 6 percent slopes. This nearly level and gently undulating, well drained soil is on low knolls and ridges on lake plains. Individual areas are irregular in shape and range from 2 to 75 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The next layer is pale brown and reddish brown silt loam about 7 inches thick. The subsoil is yellowish red, firm silty clay about 15 inches thick. The underlying material to a depth of 60 inches is light yellowish brown and brown, stratified silty clay, silty clay loam, and very fine sandy loam. In some places a layer of sandy material is below a depth of 40 inches. In other places gray mottles are in the lower part of the subsoil.

Included with this soil in mapping are small areas of the well drained Tustin soils. These soils have a sandy surface layer and are droughtier than the Perrinton soil. They are in landscape positions similar to those of the Perrinton soil. They make up 5 to 10 percent of the unit.

Permeability is slow in the Perrinton soil, and the available water capacity is high. Surface runoff is medium.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is well suited to such crops as corn, winter wheat, oats, and hay. Water erosion and deterioration of tilth are the major management concerns. Contour farming and contour stripcropping slow runoff. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to prevent crusting, control water erosion, and increase the rate of water infiltration. Tilling or harvesting when the soil is too wet can alter soil structure and can result in the formation of clods.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion. Grazing when the soil is excessively wet can cause compaction and poor tilth. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

No major hazards or limitations affect the use of this soil as woodland.

Because of the shrink-swell potential in the subsoil and underlying material, this soil is only fairly well suited to building site development. It is generally unsuited to septic tank absorption fields because of the moderately slow permeability. Widening the foundation trenches and then backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Subsurface drains also help to prevent this damage. Enlarging or pressurizing septic tank absorption fields or installing alternating drain fields helps to overcome the moderately slow permeability.

The land capability classification is IIe. The woodland ordination symbol is 4A. The Michigan soil management group is 1.5a.

46C—Perrinton loam, 6 to 12 percent slopes. This gently rolling, well drained soil is on knolls and ridges

on lake plains. Individual areas are irregular in shape and range from 2 to 15 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The next layer is pale brown and reddish brown silt loam about 7 inches thick. The subsoil is yellowish red, firm silty clay about 15 inches thick. The underlying material to a depth of 60 inches is light yellowish brown and brown, stratified silty clay, silty clay loam, and very fine sandy loam. In some places a layer of sandy material is below a depth of 40 inches. In other places gray mottles are in the lower part of the subsoil.

Included with this soil in mapping are small areas of the well drained Tustin soils. These soils have a sandy surface layer and are droughtier than the Perrinton soil. They are in landscape positions similar to those of the Perrinton soil. They make up 2 to 5 percent of the unit.

Permeability is slow in the Perrinton soil, and the available water capacity is high. Surface runoff is medium.

Most areas are used as cropland. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. Water erosion and deterioration of tilth are the major management concerns. Contour farming and contour stripcropping slow runoff. Grassed waterways are effective in controlling water erosion. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control erosion, prevent crusting, and increase the rate of water infiltration. Tilling or harvesting when the soil is excessively wet can alter soil structure and can result in the formation of clods.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling water erosion. Grazing when the soil is excessively wet can cause compaction and poor tilth. Proper stocking rates and pasture rotation help to keep the pasture in good condition.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope and a moderate shrink-swell potential in the subsoil and underlying material, this soil is only fairly well suited to building site development. It is generally unsuited to septic tank absorption fields because of the moderately slow permeability. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Widening the foundation trenches and then backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Land shaping and installing the distribution lines on the contour help to overcome the slope on sites for septic tank absorption fields. Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the moderately slow permeability.

The land capability classification is IIIe. The woodland ordination symbol is 4A. The Michigan soil management group is 1.5a.

46D—Perrinton loam, 12 to 18 percent slopes. This rolling, well drained soil is on knolls and ridges on lake plains. Individual areas are irregular in shape and range from 2 to 35 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The next layer is pale brown and reddish brown silt loam about 7 inches thick. The subsoil is yellowish red, firm silty clay about 15 inches thick. The underlying material to a depth of 60 inches is light yellowish brown and brown, stratified silty clay, silty clay loam, and very fine sandy loam. In some places a layer of sandy material is below a depth of 40 inches. In other places gray mottles are in the lower part of the subsoil.

Included with this soil in mapping are small areas of the well drained Tustin soils. These soils have a sandy surface layer and are droughtier than the Perrinton soil. They are in landscape positions similar to those of the Perrinton soil. They make up 2 to 5 percent of the unit.

Permeability is slow in the Perrinton soil, and the available water capacity is high. Surface runoff is rapid.

Most areas are used as woodland. Some areas are used as pasture or cropland.

This soil is poorly suited to corn, but crops such as winter wheat, oats, and hay can be grown. The major management concerns are water erosion, deterioration of tilth, and the equipment limitation caused by the slope. In areas where it is feasible, contour farming minimizes the equipment limitation, slows runoff, and reduces the susceptibility to water erosion. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control erosion, prevent crusting, improve tilth, and increase the rate of water infiltration. Tilling or harvesting when the soil is excessively wet can alter soil structure and can result in the formation of clods.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in slowing runoff and controlling water erosion. Restricted grazing during extremely wet periods helps to prevent compaction and helps to keep the pasture in good condition.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope and a moderate shrink-swell potential in the subsoil and underlying material, this soil

is poorly suited to building site development. It is generally unsuited to septic tank absorption fields because of the moderately slow permeability and the slope. Buildings should be designed so that they conform to the natural slope of the land. In many areas land shaping is necessary. Widening the foundation trenches and then backfilling with suitable coarse textured material helps to prevent the structural damage caused by shrinking and swelling. Subsurface drains also help to prevent this damage. Land shaping and installing the distribution lines on the contour help to overcome the slope on sites for septic tank absorption fields. Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the moderately slow permeability.

The land capability classification is IVe. The woodland ordination symbol is 4A. The Michigan soil management group is 1.5a.

46F—Perrinton loam, 35 to 70 percent slopes. This steep and very steep, well drained soil is on knolls and ridges on lake plains. Individual areas are irregularly shaped or elongated and range from 2 to 135 acres in size.

Typically, the surface layer is very dark grayish brown loam about 4 inches thick. The next layer is pale brown and reddish brown silt loam about 7 inches thick. The subsoil is yellowish red, firm silty clay about 15 inches thick. The underlying material to a depth of 60 inches is light yellowish brown and brown, stratified silty clay, silty clay loam, and very fine sandy loam. In some places a layer of sandy material is below a depth of 40 inches. In other places gray mottles are in the lower part of the subsoil.

Permeability is slow in the Perrinton soil, and the available water capacity is high. Surface runoff is very rapid.

Most areas are used as woodland. This soil is unsuited to cultivated crops and pasture because of the slope. The major management concerns are water erosion and the equipment limitation caused by the slope.

Where this soil is used as woodland, the hazard of erosion and the equipment limitation are the major management concerns. Because of the hazard of erosion, logging roads should be constructed across the slope and water should be removed by water bars, out-sloping road surfaces, culverts, and drop structures. Seeding disturbed areas after the trees are cut helps to prevent excessive soil loss. Trees cannot be easily harvested on this soil. The slope restricts the use of tractors and skidders. Cable yarding systems are generally safer and result in less surface disturbance. Because of the slope, hand planting is necessary.

Because of the slope, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIe. The woodland ordination symbol is 4R. The Michigan soil management group is 1.5a.

47B—Toogood loamy sand, 0 to 6 percent slopes. This nearly level to gently sloping, somewhat excessively drained soil is on outwash plains and terraces. Individual areas are irregular in shape and range from 2 to 715 acres in size.

Typically, the surface layer is black loamy sand about 4 inches thick. The upper part of the subsoil is dark brown, very friable loamy sand about 4 inches thick. The next part is yellowish brown, very friable loamy sand about 26 inches thick. The lower part is dark brown, very friable gravelly sandy loam about 2 inches thick. The underlying material to a depth of 60 inches is light yellowish brown very gravelly coarse sand. In places the underlying material is sand. In a few areas the soil has mottles within a depth of 30 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Watseka and poorly drained Granby soils. Watseka soils are in slight depressions and drainageways. Granby soils are in depressions and drainageways. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the upper part of the Toogood soil and very rapid in the lower part. The available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland or are left idle. Many gravel and sand pits are in areas of this soil (fig. 8).

This soil is poorly suited to corn, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are droughtiness and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material increase the available water capacity and reduce the susceptibility to soil blowing. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing. Growing small grain that is seeded in the fall or spring makes good use of the limited amount of available soil moisture.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for

Figure 8.—Toogood loamy sand, 0 to 6 percent slopes, is a source of sand and gravel.

planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of this soil as woodland.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol is 6A. The Michigan soil management group is 4a.

47C—Toogood loamy sand, 6 to 12 percent slopes. This gently rolling, somewhat excessively drained soil is on knolls and mounds on outwash plains and moraines. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is black loamy sand about 4 inches thick. The upper part of the subsoil is dark brown, very friable loamy sand about 4 inches thick. The next part is yellowish brown, very friable loamy sand about 26 inches thick. The lower part is dark brown, very friable gravelly sandy loam about 2 inches thick. The underlying material to a depth of 60 inches is light yellowish brown very gravelly coarse sand. In some areas the underlying material is sand.

Included with this soil in mapping are small areas of the well drained Metea soils. These soils are loamy in the lower part. They are in scattered areas throughout the unit. They make up 2 to 3 percent of the unit.

Permeability is rapid in the upper part of the Toogood soil and very rapid in the lower part. The available water capacity is low. Surface runoff is slow.

Most areas are used as woodland or are left idle. Crop production is not practical on this soil because of droughtiness, soil blowing, and water erosion.

This soil is poorly suited to pasture. Selection of

deep-rooted forage species for planting helps to overcome the droughtiness. Proper stocking rates, pasture rotation, and restricted use during dry periods are needed.

No major hazards or limitations affect the use of this soil as woodland.

This soil is fairly well suited to building site development and poorly suited to septic tank absorption fields. The slope is a limitation on building sites. A poor filtering capacity and the slope are limitations on sites for septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol is 6A. The Michigan soil management group is 4a.

47D—Toogood loamy sand, 12 to 18 percent slopes. This rolling, somewhat excessively drained soil is on high knolls on moraines. Individual areas are irregular in shape and range from 3 to 25 acres in size.

Typically, the surface layer is black loamy sand about 4 inches thick. The upper part of the subsoil is dark brown, very friable loamy sand about 4 inches thick. The next part is yellowish brown, very friable loamy sand about 26 inches thick. The lower part is dark brown, very friable gravelly sandy loam about 2 inches thick. The underlying material to a depth of 60 inches is light yellowish brown very gravelly coarse sand. In some areas the underlying material is sand.

Permeability is rapid in the upper part of the soil and very rapid in the lower part. The available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. This soil is unsuited to cropland and pasture because of droughtiness, the slope, and the hazards of water erosion and soil blowing.

No major hazards or limitations affect the use of this soil as woodland.

Because of the slope, this soil is poorly suited to building site development. It is poorly suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol is 6A. The Michigan soil management group is 4a.

49B—Toogood loamy sand, moderately wet, 0 to 4 percent slopes. This nearly level and very gently sloping, moderately well drained soil is on outwash plains and terraces. Individual areas are irregular in shape and range from 3 to 325 acres in size.

Typically, the surface layer is black loamy sand about 4 inches thick. The upper part of the subsoil is dark brown, very friable loamy sand about 4 inches thick. The next part is yellowish brown, very friable loamy sand about 26 inches thick. The lower part is dark brown, very friable gravelly sandy loam about 2 inches thick. The underlying material to a depth of 60 inches is brown and yellowish brown, mottled, loose very gravelly loamy sand. In some areas the soil has no gravel.

Included with this soil in mapping are small areas of Watseka and Granby soils and the somewhat excessively drained Toogood soils. Watseka soils are somewhat poorly drained, and Granby soils are poorly drained. Both of these soils are in the lower landscape positions. The somewhat excessively drained Toogood soils are in the slightly higher landscape positions. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the upper part of the Toogood soil and very rapid in the lower part. The available water capacity is low. Surface runoff is slow. The seasonal high water table is at a depth of 2 to 3 feet from late fall through spring and during excessively wet periods.

Most areas are used as woodland or are left idle.

This soil is poorly suited to corn, but such crops as winter wheat, oats, and hay can be grown. The major management concerns are droughtiness and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material increase the available water capacity and reduce the susceptibility to soil blowing. Vegetative barriers and field windbreaks also help to control soil blowing. Growing small grain that is seeded in the fall or spring makes good use of the limited amount of available soil moisture.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

No major hazards or limitations affect the use of this soil as woodland.

Because of the seasonal high water table, this soil is only fairly well suited to building site development. Buildings with basements can be constructed on suitable well compacted fill material, which raises the site. A drainage system lowers the water table. Because of the water table and a poor filtering capacity, the soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water. Special construction methods may be needed to raise the site above the water table and to increase the filtering capacity.

The land capability classification is IVs. The woodland ordination symbol is 6A. The Michigan soil management group is 4a.

51B—Thetford loamy fine sand, 0 to 4 percent slopes. This nearly level and very gently sloping, somewhat poorly drained soil is on low knolls and ridges on outwash plains, lake plains, and moraines. Individual areas are irregular in shape and range from 2 to 375 acres in size.

Typically, the surface layer is very dark grayish brown loamy fine sand about 9 inches thick. The subsoil is about 41 inches thick. The upper part is dark yellowish brown, mottled, very friable loamy fine sand. The next part is yellowish brown, mottled loamy fine sand. The lower part is light yellowish brown and yellowish brown loamy fine sand that has thin lamellae of brown fine sandy loam and loamy fine sand. The underlying material to a depth of 60 inches is yellowish brown fine sand.

Included with this soil in mapping are small areas of Pipestone and Kingsville soils. Pipestone soils are in landscape positions similar to those of the Thetford soil. They do not have lamellae of fine sandy loam in the subsoil. Kingsville soils are in slight depressions. Included soils make up less than 10 percent of the unit.

Permeability is rapid in the Thetford soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 1 to 2 feet from late fall through spring and during excessively wet periods.

Most areas are used as woodland or are left idle. A few areas are used as pasture or cropland.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are droughtiness, soil blowing, and wetness. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. Suitable filtering material is needed around tile lines to keep fine sand from flowing into the lines. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface can help to control soil blowing and conserve moisture. Growing cover crops and green manure crops and regularly adding organic material to the soil increase the available water capacity and help to control soil blowing. Vegetative barriers and field windbreaks also help to control soil blowing.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during excessively wet or dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation is the major management concern. Ruts can form if heavy equipment is used during wet periods. The equipment should be used only when the soil is relatively dry or frozen.

Because of wetness, this soil is poorly suited to building site development and generally is unsuitable as a site for septic tank absorption fields. A surface or subsurface drainage system lowers the water table on building sites. Buildings can be constructed on suitable well compacted fill material, which raises the site. All sanitary facilities should be connected to municipal sewage systems. Sites that are better suited to septic systems generally are available.

The land capability classification is IIIw. The woodland ordination symbol is 3W. The Michigan soil management group is 5b.

52—Linwood muck. This nearly level, very poorly drained soil is in depressions on lake plains, outwash plains, and moraines. Slope ranges from 0 to 2 percent. Individual areas are irregularly shaped or oval and range from 2 to 40 acres in size.

Typically, the surface layer is black muck about 25 inches thick. The next 4 inches is dark brown, mottled, friable sandy loam. The next 7 inches is very dark grayish brown, mottled loam that has thin strata of sand. The next 14 inches is dark grayish brown, mottled clay loam. The underlying material to a depth of 60 inches is gray, mottled sandy clay loam. In places the muck is less than 16 inches thick.

Included with this soil in mapping are small areas of Edwards, Carlisle, and Parkhill soils. The very poorly drained Edwards soils generally are on the edges of the mapped areas. They are underlain by marl at a depth of 16 to 50 inches. The very poorly drained Carlisle soils generally are in the middle of the mapped areas. They are more than 50 inches deep to loamy material. The poorly drained, loamy Parkhill soils generally are on the edges of the mapped areas. Included soils make up 4 to 10 percent of the unit.

Permeability is moderately slow to moderately rapid in the organic layers of the Linwood soil and moderately slow in the mineral layers. The available water capacity is very high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from fall through late spring and during excessively wet periods.

Most areas are used as woodland.

This soil is poorly suited to pasture. Grazing when the soil is wet can destroy forage plants and damage soil structure.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy planting and harvesting equipment is limited by wetness and by low soil strength. The equipment should be used only when the soil is frozen. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Windthrown trees should be periodically removed. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil.

Because of wetness and low strength, this soil is unsuited to septic tank absorption fields and building site development.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is M/3c.

53—Parkhill loam. This poorly drained, nearly level soil is in depressions on till plains and moraines. Slope ranges from 0 to 2 percent. Individual areas range from 3 to 75 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsoil is grayish brown, mottled, friable loam about 16 inches thick. The underlying material to a depth of 60 inches is brown and reddish brown, mottled loam and brown clay loam.

Included with this soil in mapping are small areas of the very poorly drained Wauseon and poorly drained Sickles soils. These soils are in landscape positions similar to those of the Parkhill soil. Wauseon soils have more clay than the Parkhill soil. Sickles soils are sandy in the upper part. Included soils make up 2 to 5 percent of the unit.

Permeability is moderately slow in the Parkhill soil, and the available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late fall through spring and during excessively wet periods.

Most areas are used as woodland. Some areas are used as cropland or are left idle.

If drained, this soil is well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are wetness and deterioration of tilth. If adequate drainage outlets are available, a subsurface drainage system is effective in removing excess water. Draining many areas is difficult, however, because outlets are not readily available. Tilling or harvesting when the soil is too wet can alter soil structure and can result in compaction and the formation of clods. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops improve tilth and increase the rate of water infiltration.

This soil is poorly suited to pasture. If drainage outlets are available, a surface drainage system can help to remove excess water. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to prevent compaction and deterioration of the pasture. The forage species that can tolerate wetness should be selected for planting.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Equipment should be used only when the soil is relatively dry or frozen. When the soil is wet, logging roads tend to become slippery and ruts form easily. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

Because of wetness, this soil is generally unsuited to building site development and septic tank absorption fields. Better suited sites generally are available.

The land capability classification is IIw. The woodland ordination symbol is 3W. The Michigan soil management group is 2.5c.

55—Sickles loamy fine sand. This poorly drained, nearly level soil is in depressions on lake plains. Slope ranges from 0 to 2 percent. Individual areas range from 2 to 230 acres in size.

Typically, the surface layer is black loamy fine sand about 8 inches thick. The next 12 inches is grayish brown, very friable loamy fine sand. The next 7 inches is light brownish gray, mottled, friable, stratified loamy fine sand and silt loam. The underlying material to a depth of 60 inches is brown, mottled silty clay.

Included with this soil in mapping are small areas of the poorly drained Lamson and somewhat poorly drained Del Rey soils. Lamson soils have less clay throughout than the Sickles soil. They are in landscape positions similar to those of the Sickles soil. Del Rey

soils are on slight rises. Included soils make up 2 to 15 percent of the unit.

Permeability is rapid in the upper part of the Sickles soil and very slow in the lower part. The available water capacity is moderate. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface from late fall through spring and during excessively wet periods.

Most areas are used as woodland. Some areas are used as cropland or are left idle.

If drained, this soil is fairly well suited to cultivated crops. The major management concerns are wetness, droughtiness, and soil blowing. A subsurface drainage system is effective in reducing wetness. Suitable filtering material may be needed around tile lines to keep fine sand from flowing into the lines. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops increase the available water capacity during dry periods and help to control soil blowing.

This soil is well suited to pasture. If drainage outlets are available, a surface drainage system can help to remove excess water. Proper stocking rates, pasture rotation, and restricted grazing during excessively wet or dry periods are needed. The forage species that can tolerate wetness should be selected for planting.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Equipment should be used only when the soil is relatively dry or frozen. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

Because of wetness, this soil is generally unsuited to building site development and septic tank absorption fields. Better suited sites generally are available.

The land capability classification is IIIw. The woodland ordination symbol is 5W. The Michigan soil management group is 4/1c.

60B—Grattan sand, 0 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on the tops and side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 3 to 90 acres in size.

Typically, the surface layer is black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The underlying material to a depth of 60 inches is strong brown sand. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other places mottles are within a depth of 30 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soils. These soils are in small depressions. They make up as much as 5 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. Some areas were formerly used as cropland but are now idle. Because of droughtiness, crop production generally is not practical on this soil.

This soil is poorly suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Selection of deep-rooted forage species for planting can help to overcome the droughtiness. Limiting the stocking rates and grazing mainly during wet periods help to prevent deterioration of the pasture. Pasture rotation is beneficial.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol is 9S. The Michigan soil management group is 5.3a.

60C—Grattan sand, 6 to 18 percent slopes. This gently rolling and rolling, excessively drained soil is on the side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The underlying material to a depth of 60

inches is strong brown sand. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soils. These soils are in small depressions. They make up 2 to 3 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff in slow.

Most areas are used as woodland. Some areas are left idle. Because of droughtiness, crop production generally is not practical on this soil.

This soil is poorly suited to pasture. A cover of pasture plants is effective in controlling water erosion and soil blowing. Selection of deep-rooted forage species for planting can help to overcome the droughtiness. Limiting the stocking rates and grazing mainly during wet periods help to prevent deterioration of the pasture. Pasture rotation is beneficial.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIIs. The woodland ordination symbol is 9S. The Michigan soil management group is 5.3a.

60D—Grattan sand, 18 to 35 percent slopes. This hilly and steep, excessively drained soil is on ridges and knolls on moraines. Individual areas are irregularly shaped or elongated and range from 2 to 40 acres in size.

Typically, the surface layer is black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The underlying material to a depth of 60 inches is strong brown, loose sand. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Permeability is rapid, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. Some areas are left idle. This soil is unsuited to cultivated crops and pasture because of droughtiness and the slope.

Where this soil is used as woodland, the hazard of erosion, the equipment limitation, and seedling mortality are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. The slope limits the use of equipment. Loose sand can interfere with the traction of wheeled equipment. Skid trails and logging roads should be built on the contour or on the gentler slopes. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol is 9R. The Michigan soil management group is 5.3a.

62—Jebavy sand. This nearly level, poorly drained soil is in depressions and drainageways on outwash plains and lake plains. Slope ranges from 0 to 2 percent. Individual areas are irregular in shape and range from 2 to 60 acres in size.

Typically, the surface layer is dark brown sand about 6 inches thick. The subsurface layer is pinkish gray sand about 5 inches thick. The subsoil is black, dark reddish brown, dark brown, and strong brown, mottled sand about 31 inches thick. More than 50 percent of the subsoil is cemented. The underlying material to a depth of 60 inches is yellowish brown and pale brown, mottled sand. In places the subsoil is not cemented.

Included with this soil in mapping are small areas of Pipestone soils. These soils are somewhat poorly drained and are on slight rises. They make up 2 to 5 percent of the unit.

Permeability is rapid in the upper and lower parts of the Jebavy soil and slow in the cemented part. The available water capacity is low. Surface runoff is very slow. The seasonal high water table is near or above the surface from fall through late spring.

Most areas are used as woodland. A few areas are left idle.

This soil is unsuited to cropland because of wetness. Overcoming the wetness generally is not practical.

This soil is poorly suited to pasture. If possible, a surface drainage system should be installed to reduce the wetness. The forage species that can tolerate the wetness should be selected for planting. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. Heavy equipment should be used only when the soil is relatively dry or frozen. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow. Planting containerized seedlings or larger than usual nursery stock and planting on the ridges of furrows can reduce the seedling mortality rate.

Because of wetness, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is Vw. The woodland ordination symbol is 2W. The Michigan soil management group is 5b-h.

65—Wauseon loam. This very poorly drained, nearly level soil is in depressions on lake plains. Slope ranges from 0 to 2 percent. Individual areas range from 2 to 145 acres in size.

Typically, the surface layer is very dark gray loam about 17 inches thick. The upper part of the subsoil is gray, mottled, friable loam about 11 inches thick. The lower part is gray, mottled, friable silty clay loam about 4 inches thick. The underlying material to a depth of 60 inches is olive brown and olive gray, mottled silty clay. In places the underlying material has thin strata of silt loam, fine sand, and sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Del Rey soils on low knolls. These soils make up 2 to 5 percent of the unit.

Permeability is slow or very slow in the Wauseon soil, and the available water capacity is high. Surface runoff is very slow or ponded. The seasonal high water table is above the surface to 1 foot below the surface from late fall through spring and during excessively wet periods.

Most areas are used as cropland or woodland. Some areas are used as pasture or are left idle.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are the seasonal high water table, puddling and crusting, and the slow rate at which the soil warms up in the spring. Because of wetness, a drainage system is necessary for most crops. It minimizes puddling and crusting. Puddling and crusting also can be minimized by tilling or harvesting when the soil is not excessively wet and by applying a system of conservation tillage.

This soil is well suited to pasture. Grazing when the soil is wet results in surface compaction, excessive runoff, and damage to soil structure. The legumes and grasses that are tolerant of wet conditions grow best in undrained areas.

This soil is poorly suited to woodland. The major management concerns are the equipment limitation, seedling mortality, and the hazard of windthrow. The wet, sticky nature of the soil limits the use of equipment during wet periods. Because of wetness, seedling mortality, and plant competition, trees are not planted on this soil. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

This soil is generally unsuited to building site development and septic tank absorption fields because of wetness and the slow permeability. Better suited sites generally are available.

The land capability classification is IIIw. The woodland ordination symbol is 2W. The Michigan soil management group is 3/1c.

70—Udorthents, loamy, nearly level and gently sloping. These nearly level to undulating, well drained or moderately well drained soils are on till plains and moraines. Slope ranges from 0 to 6 percent. Some areas have been excavated, and other areas have been filled. The soil material has been so altered that identification of the soil series is not possible. Individual areas are irregularly shaped or rectangular and range from 2 to 40 acres in size.

The texture of these soils ranges from sandy loam to clay loam. The color varies.

Included with these soils in mapping are small areas of somewhat poorly drained and poorly drained soils. These included soils may be sandy or clayey or have organic material below a depth of 5 feet. They make up 5 to 10 percent of the unit.

Most areas are used as sites for buildings or are left idle. Onsite investigation is necessary to determine the suitability for specific uses.

No interpretive groups are assigned.

72—Udipsamments, nearly level and gently sloping. These nearly level to undulating, well drained or moderately well drained soils are on outwash plains and lake plains. Slope ranges from 0 to 6 percent.

Some areas have been excavated, and other areas have been filled. Blowouts are in some areas. The soil material has been so altered that identification of the soil series is not possible. Individual areas are irregularly shaped or rectangular and range from 2 to 195 acres in size.

The texture of these soils ranges from fine sand to gravelly coarse sand. The color varies.

Included with these soils in mapping are small areas of somewhat poorly drained and poorly drained soils. These included soils may be loamy or sandy or have organic material below a depth of 5 feet. They make up 5 to 10 percent of the unit.

Most areas are used as sites for buildings or are left idle. Onsite investigation is necessary to determine the suitability for specific uses.

No interpretive groups are assigned.

82—Algansee loamy fine sand. This nearly level and very gently sloping, somewhat poorly drained soil is on the first or second bottoms of flood plains. It is occasionally flooded. Slope ranges from 0 to 3 percent. Individual areas are broad to narrow and elongated and range from 3 to 90 acres in size.

Typically, the surface layer is dark grayish brown loamy fine sand about 7 inches thick. The next layer is brown, friable loamy fine sand about 5 inches thick. Below this to a depth of 60 inches is very pale brown and light gray, mottled fine sand. In places gravelly sand and gravel are in the underlying material.

Included with this soil in mapping are small areas of steep and very steep soils. Also included are the poorly drained Glendora soils in slight depressions and drainageways; small areas of the somewhat poorly drained Ceresco soils in landscape positions similar to those of the Algansee soil; and, on natural levees, small areas of soils that are better drained than the Algansee soil. Ceresco soils are dominantly loamy throughout. The steep and very steep soils are along the edges of the mapped areas, adjacent to uplands. They make up about 5 percent of the unit. The other included soils make up as much as 15 percent of the unit.

Permeability is rapid in the Algansee soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 1 to 2 feet from late fall through spring and during excessively wet periods.

Most areas are left idle or are used as woodland. A few areas are used as pasture or cropland.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. Wetness, flooding, soil blowing, and droughtiness are the major management concerns. A subsurface drainage system and surface drains are effective in removing excess water. Draining some areas is difficult because drainage outlets are not readily available. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material help to control soil blowing and increase the available water capacity.

This soil is well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. A good surface drainage system lowers the water table and removes floodwater. Proper stocking rates, pasture rotation, timely deferment of grazing, and restricted use during wet periods help to keep the pasture in good condition. The forage species that can tolerate the wetness should be selected for planting.

Where this soil is used as woodland, the equipment limitation is a major management concern. Ruts can form if heavy equipment is used during wet periods. The equipment should be used only when the soil is relatively dry or frozen.

Because of wetness and flooding, this soil is unsuited to building site development and septic tank absorption fields. Better suited sites generally are available.

The land capability classification is IIIw. The woodland ordination symbol is 4W. The Michigan soil management group is L-4c.

88—Ceresco fine sandy loam. This nearly level, somewhat poorly drained soil is on the first or second bottoms of flood plains. It is occasionally flooded. Slope ranges from 0 to 3 percent. Individual areas are narrow to broad and elongated and range from 3 to 150 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 11 inches thick. The subsurface layer is dark brown very fine sandy loam about 6 inches thick. The subsoil is grayish brown, mottled, friable very fine sandy loam about 13 inches thick. The underlying material to a depth of 60 inches is stratified pale brown and grayish brown, mottled fine sandy loam and very fine sandy loam. In some places the underlying material is sand and gravel. In other places the soil has bands of sand, fine sand, or loamy sand 20 to 30 inches thick.

Included with this soil in mapping are small areas of steep and very steep soils. Also included are small areas of the poorly drained Cohoctah and somewhat poorly drained Algansee soils. Cohoctah soils are in the slightly lower landscape positions and in meander scars. Algansee soils are dominantly sandy throughout. They are in landscape positions similar to those of the Ceresco soil. The steep and very steep soils are along the edges of the mapped areas, adjacent to uplands. They make up about 5 percent of the unit. The other

included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Ceresco soil, and the available water capacity is high. Surface runoff is very slow. The seasonal high water table is at a depth of 1 to 2 feet from fall through spring and during excessively wet periods.

Most areas are used as woodland or are left idle. Some areas are used as cropland or pasture.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are flooding, wetness, and deterioration of tilth. If a subsurface drainage system is installed, crops can be planted after floodwater recedes. Suitable filtering material is needed around tile lines to keep fine sand and silt from flowing into the lines. Draining some areas is difficult because drainage outlets are not readily available. Tilling or harvesting when the soil is too wet can alter soil structure and can result in compaction and the formation of clods. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops improve tilth.

This soil is well suited to pasture. Proper stocking rates, pasture rotation, and restricted use during wet periods help to keep the pasture in good condition. If possible, a surface drainage system should be installed to reduce the wetness. The forage species that can tolerate the wetness should be selected for planting.

Where this soil is used as woodland, the major management concern is the equipment limitation. Ruts can form if heavy equipment is used when the soil is wet. The equipment should be used only when the soil is relatively dry or frozen.

Because of wetness and flooding, this soil is unsuited to building site development and septic tank absorption fields. Better suited sites generally are available.

The land capability classification is IIIw. The woodland ordination symbol is 4W. The Michigan soil management group is L-2c.

90—Histosols and Aquents, ponded. These nearly level, very poorly drained soils are in bogs, along drainageways, and in depressions in the uplands. They are covered by shallow water most of the year. Slopes are 0 to 1 percent. The Histosols are organic, and the Aquents are sandy or loamy. Individual areas are round, elongated, or irregular in shape and range from 2 to 40 acres in size. Some areas are made up entirely of either Histosols or Aquents, and others are made up of both soils.

The texture and color of these soils vary. Permeability and the available water capacity also vary. Surface runoff is ponded. The high water table is above the surface most of the year.

Most areas support native vegetation, primarily cattails and reeds. These soils are well suited to wetland wildlife but are unsuited to most other uses. They provide habitat for many aquatic animals, including ducks, geese, and other birds. Most areas collect, store, and filter runoff from the adjacent uplands and recharge the supply of ground water.

These soils are unsuited to septic tank absorption fields and building site development because of ponding and wetness.

No interpretive groups are assigned.

91B—Plainfield sand, 0 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on outwash plains. Individual areas are irregular in shape and range from 2 to 2,600 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The underlying material to a depth of 60 inches is very pale brown sand. In some areas mottles are within a depth of 30 inches. In other areas the subsoil is fine sand.

Included with this soil in mapping are small areas of the excessively drained Coloma, somewhat excessively drained Toogood, and excessively drained Grattan soils. These soils are in landscape positions similar to those of the Plainfield soil. Coloma soils have strata of loamy sand in the lower part. Toogood soils have gravelly layers in the lower part. Grattan soils have a subsoil that is darker than that of the Plainfield soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Plainfield soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland or are left idle (fig. 9). Some areas are planted to Christmas trees.

This soil is poorly suited to most crops, but such crops as winter wheat, oats, and hay can be grown. Droughtiness and soil blowing are the major management concerns. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface increases the available water capacity and reduces the susceptibility to soil blowing.

This soil is poorly suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Selection of deep-rooted forage species for planting helps to overcome the droughtiness. Limited stocking rates, pasture rotation, and restricted use during dry periods are needed.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled

Figure 9.—Black oak and white oak in an area of Plainfield sand, 0 to 6 percent slopes.

equipment, especially during dry periods. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol is 8S. The Michigan soil management group is 5.3a.

91C—Plainfield sand, 6 to 18 percent slopes. This gently rolling and rolling, excessively drained soil is on the uneven side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 2 to 500 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The underlying material to a depth of 60 inches is very pale brown sand. In some areas the subsoil has thin layers of loamy sand. In a few areas it is fine sand.

Permeability is rapid, and the available water capacity is low. Surface runoff is slow.

Most areas are used as woodland or are left idle. Some areas are planted to Christmas trees. Because of droughtiness and the hazard of soil blowing, this soil is unsuited to cultivated crops.

This soil is poorly suited to pasture. A cover of pasture plants is effective in controlling soil blowing and water erosion. Selection of deep-rooted forage species for planting helps to overcome the droughtiness. Limited stocking rates, pasture rotation, and restricted use during dry periods are needed.

Where this soil is used as woodland, the equipment

limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas interfere with the traction of wheeled equipment, especially during dry periods. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is fairly well suited to building site development and poorly suited to septic tank absorption fields. The slope is a limitation on sites for buildings. A poor filtering capacity and the slope are limitations on sites for septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol is 8S. The Michigan soil management group is 5.3a.

91D—Plainfield sand, 18 to 35 percent slopes. This moderately steep and steep, excessively drained soil is on ridges and knolls on outwash plains and moraines. Individual areas are irregularly shaped or elongated and range from 3 to 175 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The underlying material to a depth of 60 inches is very pale brown sand. In some areas the subsoil has thin layers of loamy sand. In a few areas it is fine sand.

Permeability is rapid, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland or are left idle. Some areas are used as pasture. This soil is unsuited to cultivated crops and pasture because of droughtiness, the hazard of water erosion, and the equipment limitation caused by the slope.

Where this soil is used as woodland, the hazard of erosion, the equipment limitation, and seedling mortality are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. The slope limits the use of equipment. Loose sand can interfere with the traction of wheeled equipment. Logging roads and skid trails should be built on the contour or on the gentler slopes. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, this soil is generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol is 8R. The Michigan soil management group is 5.3a.

91F—Plainfield sand, 35 to 50 percent slopes. This steep and very steep, excessively drained soil is on side slopes and ridges on outwash plains and moraines. Individual areas are irregularly shaped or elongated and range from 2 to 300 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The underlying material to a depth of 60 inches is very pale brown sand. In some areas the subsoil has thin layers of loamy sand. In a few areas it is fine sand.

Permeability is rapid, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. This soil is unsuited to cultivated crops and pasture because of droughtiness, the hazard of water erosion, and the equipment limitation caused by the slope.

Where this soil is used as woodland, the hazard of erosion, the equipment limitation, and seedling mortality are the major management concerns. Trees cannot be easily harvested on this soil. The slope restricts the use of tractors and skidders. Cable yarding systems are generally safer and result in less surface disturbance. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Because of droughtiness, loss of planted or natural tree seedlings can exceed 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate. Because of the slope, machine planting is generally impractical on this soil.

Because of the slope, this soil is unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol is 8R. The Michigan soil management group is 5.3a.

92B—Selfridge loamy sand, 0 to 4 percent slopes. This nearly level and gently undulating, somewhat poorly drained soil is in nearly flat areas, on slight rises,

and in small depressions on till plains and moraines. Individual areas are irregular in shape and range from 2 to 315 acres in size.

Typically, the surface layer is dark brown loamy sand about 14 inches thick. The subsoil is about 23 inches thick. It is mottled. The upper part is yellowish brown, very friable loamy sand, and the lower part is brown, firm loam. The underlying material to a depth of 60 inches is brown, mottled clay loam. In places the upper part of the soil is sandy loam. In some areas the depth to carbonates is more than 40 inches. In a few areas the soil does not have loam or clay loam within 40 inches of the surface.

Included with this soil in mapping are small areas of the poorly drained Sickles soils. These soils are in drainageways and depressions. They make up 1 to 5 percent of the unit.

Permeability is rapid in the upper part of the Selfridge soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is very slow. The seasonal high water table is at a depth of 1 to 2 feet from late fall through spring and during excessively wet periods.

Most areas are used as cropland or are left idle. Some areas are used as pasture or woodland.

This soil is fairly well suited to such crops as corn, winter wheat, oats, and hay. The major management concerns are water erosion, wetness, and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops help to control water erosion and soil blowing and increase the available water capacity. Wind stripcropping, vegetative barriers, and field windbreaks also help to control soil blowing. If drainage outlets are available, a subsurface drainage system is effective in reducing wetness. Suitable filtering material may be needed around tile lines to keep fine sand and silt from flowing into the lines.

This soil is well suited to pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods or prolonged dry periods help to keep the pasture in good condition. The forage species that can tolerate wetness should be selected for planting.

Where this soil is used as woodland, the major management concern is the equipment limitation. Ruts can form if heavy equipment is used when the soil is excessively wet. The equipment should be used only when the soil is moist and friable or is frozen.

Because of wetness, this soil is poorly suited to building site development. It is generally unsuited to septic tank absorption fields because of wetness and the moderately slow permeability in the loamy subsoil and underlying material. A surface or subsurface drainage system lowers the water table on building sites. The buildings can be constructed on suitable well compacted fill material, which raises the site. Better suited sites generally are available.

The land capability classification is IIIe. The woodland ordination symbol is 6W. The Michigan soil management group is 4/2b.

93—Pits, sand and gravel. This map unit consists of open excavations from which sand or gravel has been removed for use elsewhere as fill or aggregate. The material that remains supports few plants. The pit bottoms are dry or are ponded seasonally or throughout the year. Individual areas vary considerably in shape and range from 2 to 45 acres in size.

Most areas are used by wildlife or are still being mined. A few areas are used for recreation. Onsite investigation is necessary to determine the suitability for specific uses.

No interpretive groups are assigned.

94B—Brems sand, 0 to 4 percent slopes. This nearly level and gently undulating, moderately well drained soil is in nearly flat areas and in slight depressions on outwash plains and moraines. Individual areas are irregular in shape and range from 3 to 360 acres in size.

Typically, the surface layer is dark brown sand about 8 inches thick. The subsoil is mottled sand about 38 inches thick. The upper part is strong brown and very friable, and the lower part is brownish yellow and loose. The underlying material to a depth of 60 inches is light yellowish brown, mottled, loose sand. In some areas the subsoil is reddish brown and has chunks of brittle material. In other areas the subsoil is grayer.

Included with this soil in mapping are small areas of the excessively drained Plainfield soils. These soils are on slight rises. They make up 1 to 5 percent of the unit.

Permeability is rapid in the Brems soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 2 to 3 feet during winter and spring and excessively wet periods.

Most areas are used as woodland or are left idle (fig. 10). A few areas are used as pasture.

This soil is poorly suited to such crops as corn, but winter wheat, oats, and hay can be grown. The major management concerns are droughtiness and soil blowing. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, green manure crops, and regular additions of organic material increase the available water capacity and reduce the susceptibility to soil blowing. Growing small grain crops that are planted

Figure 10.—A red pine plantation in an area of Brems sand, 0 to 4 percent slopes.

in fall or early in spring makes good use of the limited amount of available soil moisture.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted use during dry periods help to keep the pasture in good condition. Selection of deep-rooted forage species for planting helps to overcome the droughtiness.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of wetness, this soil is only fairly well suited to building site development. Buildings with basements can be constructed on suitable well compacted fill material, which raises the site. A drainage system lowers the water table. Because of wetness and a poor filtering capacity, the soil is poorly suited to septic tank absorption fields. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water. Special construction methods, such as filling or mounding the absorption field with suitable material, may be needed to raise the site above the water table and increase the filtering capacity.

The land capability classification is IVs. The woodland ordination symbol is 3S. The Michigan soil management group is 5b.

95A—Abscota loamy sand, 0 to 3 percent slopes. This nearly level and very gently sloping, moderately well drained soil is in large, flat areas and on natural levees on flood plains. It is occasionally flooded. Individual areas are irregularly shaped or narrow and elongated and range from 2 to 70 acres in size.

Typically, the surface layer is dark brown loamy sand about 9 inches thick. The subsoil is dark brown, very friable loamy fine sand about 7 inches thick. The underlying material to a depth of 60 inches is dark yellowish brown, brownish yellow, light yellowish brown, and very pale brown, mottled sand. In places the water table is below a depth of 5 feet.

Included with this soil in mapping are small areas of steep and very steep soils. These soils are along the edges of the mapped areas, adjacent to uplands. Also included are the somewhat poorly drained Algansee soils in the slightly lower landscape positions and adjacent to natural levees. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Abscota soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 2.5 to 5.0 feet during the winter and spring and during excessively wet periods.

Most areas are used as woodland or are left idle. Some areas are used as pasture.

This soil is poorly suited to most crops, but such crops as winter wheat, oats, and hay can be grown. Droughtiness, soil blowing, and the occasional flooding are the major management concerns. A system of conservation tillage that does not invert the soil and leaves all or part of the crop residue on the surface, cover crops, and green manure crops conserve moisture and reduce the hazard of soil blowing. Wind stripcropping and vegetative barriers also help to control soil blowing.

This soil is fairly well suited to pasture. A cover of pasture plants is effective in controlling soil blowing. Proper stocking rates, pasture rotation, and restricted grazing during dry periods help to keep the pasture in good condition.

Where this soil is used as woodland, the equipment limitation and seedling mortality are the main management concerns. Ruts can form if heavy equipment is used when the soil is wet. The seedling mortality rate can be reduced by harvest methods that leave some mature trees to provide shade and protection from the wind. Nursery stock that is larger than usual or is containerized, reinforcement planting, and special site preparation, such as furrowing and applying herbicide, may be needed.

Because of wetness and flooding, this soil is unsuited to building site development and septic tank absorption fields. Better suited sites generally are nearby.

The land capability classification is IVs. The woodland ordination symbol is 4S. The Michigan soil management group is L-4a.

96A—Pipestone-Kingsville complex, 0 to 3 percent slopes. These nearly level and very gently sloping soils are on outwash plains and lake plains. Individual areas are irregular in shape and range from 2 to 170 acres in size. They are 30 to 50 percent somewhat poorly drained Pipestone soil and 25 to 40 percent poorly drained Kingsville soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Pipestone soil has a surface layer of very dark gray sand about 7 inches thick. The subsurface layer is pale brown, mottled sand about 6 inches thick. The subsoil is about 16 inches of reddish brown and brown, mottled, friable and loose sand that has common fragments of reddish brown and brown, weakly cemented material. The underlying material to a depth of 60 inches is light yellowish brown, mottled sand. In places the subsoil is not so red and does not have fragments of reddish brown material.

Typically, the Kingsville soil has a surface layer of black mucky sand about 7 inches thick. The subsoil is pale brown, loose sand about 28 inches thick. The underlying material to a depth of 60 inches is brown sand.

Included with these soils in mapping are small areas of the poorly drained Jebavy soils. These included soils have a cemented subsoil. They are in scattered areas throughout the unit. They make up 3 to 20 percent of the unit.

Permeability is rapid in the Pipestone soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is at a depth of 0.5 foot to 1.5 feet from fall through late spring and during excessively wet periods.

Permeability is rapid in the Kingsville soil, and the available water capacity is low. Surface runoff is very slow. The seasonal high water table is near or above the surface from late fall through spring and during excessively wet periods.

Most areas are used as woodland or are left idle. These soils are poorly suited or unsuited to cropland because of wetness and droughtiness.

These soils are poorly suited to pasture. If possible, a surface drainage system should be installed to reduce the wetness. The forage species that can tolerate the wetness should be selected for planting. Proper stocking rates, pasture rotation, and restricted grazing during wet periods are needed.

Where these soils are used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy equipment should be restricted to periods when the soils are relatively dry or frozen. Planting containerized seedlings or larger than usual nursery stock and planting on the ridges of furrows can reduce the seedling mortality rate. Harvest methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

Because of wetness, these soils are generally unsuited to septic tank absorption fields and building site development.

The land capability classification is IVw. The woodland ordination symbol assigned to the Pipestone soil is 3W, and that assigned to the Kingsville soil is 5W. The Michigan soil management groups are 5b and 5c.

97B—Urban land-Metea-Marlette complex, 0 to 8 percent slopes. This map unit consists of Urban land and nearly level to gently rolling areas of a well drained Metea soil and a moderately well drained Marlette soil. The unit is in broad areas and on the side slopes of knolls and ridges on till plains. Individual areas are rectangular or irregular in shape and range from 100 to 375 acres in size. They are 40 to 80 percent Urban land and 20 to 50 percent Metea, Marlette, and similar soils. The Urban land and the Metea and Marlette soils occur as areas so intricately mixed that separating them in mapping was not practical.

Urban land is covered with buildings, concrete, asphalt, and other impervious materials that so obscure or alter the soils that identification of the soil series is not feasible.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown,

very friable and loose sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some areas the subsoil is mottled. In other areas the sandy material is more than 40 inches thick. In places sand is below the loamy subsoil.

Typically, the Marlette soil has a surface layer of dark grayish brown loam about 10 inches thick. The next layer is brown and pale brown, mottled, friable loam about 8 inches thick. The subsoil is brown, mottled, firm clay loam about 11 inches thick. The underlying material to a depth of 60 inches is yellowish brown, mottled loam. In some small areas sand is below a depth of 40 inches.

Included in this unit in mapping are small areas of Capac, Selfridge, and Spinks soils. The somewhat poorly drained Capac and Selfridge soils are in the lower landscape positions, such as depressions and drainageways. Spinks soils are sandy throughout. They are in landscape positions similar to those of the Metea and Marlette soils. Also included are small areas of soils that have been radically altered. Some of the higher areas have been leveled, and some of the lower areas have been filled. Included soils make up 10 to 25 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is medium.

Most areas are in residential, commercial, or industrial developments. The suitability for specific uses should be determined by onsite investigation. The Metea soil is well suited to building site development and fairly well suited to lawns, gardens, parks, and environmental plantings. The Marlette soil is fairly well suited to building site development and well suited to lawns, gardens, parks, and environmental plantings.

The Metea soil is fairly well suited to grasses, flowers, vegetables, trees, and shrubs. The main management concerns are droughtiness and the hazard of soil blowing. Deep-rooted plants or plants that are highly tolerant of dry soil conditions should be selected for planting. If the surface is bare, the sandy material is susceptible to blowing. Measures that control soil blowing include mulching and grass sodding. In areas where the subsoil is exposed, additions of suitable topsoil may be necessary before vegetation can be established.

The Metea soil is well suited to building site development. Sanitary facilities should be connected to municipal sewer systems.

The Marlette soil is well suited to grasses, flowers, vegetables, trees, and shrubs. The main management concern is the hazard of water erosion. In disturbed areas where the surface is bare, soil material can erode into the local drainage system and pollute nearby streams, rivers, and lakes with sediments. Measures that control water erosion include mulching, grass sodding, and diversions. In areas where the subsoil is exposed, additions of suitable topsoil may be necessary before vegetation can be established.

The Marlette soil is fairly well suited to building site development. Sanitary facilities should be connected to municipal sewer systems.

No interpretive groups are assigned.

98F—Plainfield-Perrinton complex, 35 to 70 percent slopes. These steep and very steep soils are in areas where sandy outwash overlies lake-laid sediments. These areas formed when drainageways cut through the soils. The excessively drained Plainfield soil is on the upper part of the slopes, and the well drained Perrinton soil is on the lower part. Individual areas are elongated and range from 5 to 380 acres in size. They are 45 to 60 percent Plainfield soil and 40 to 55 percent Perrinton soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Plainfield soil has a surface layer of black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The underlying material to a depth of 60 inches is very pale brown sand.

Typically, the Perrinton soil has a surface layer of very dark grayish brown loam about 4 inches thick. The next layer is pale brown and reddish brown silt loam about 7 inches thick. The subsoil is yellowish red, very firm silty clay about 15 inches thick. The underlying material to a depth of 60 inches is light yellowish brown and brown, stratified silty clay, silty clay loam, and very fine sandy loam.

Included with these soils in mapping are small areas of the excessively drained Grattan soils on the upper part of the slopes. Also included are small seepy areas at the contact between the sandy material and the lake-laid sediments and at the base of the slopes. Included soils make up 2 to 15 percent of the unit.

Permeability is rapid in the Plainfield soil, and the available water capacity is low. Surface runoff is medium.

Permeability is slow in the Perrinton soil, and the available water capacity is high. Surface runoff is rapid.

Most areas are used as woodland. Because of the slope, these soils are unsuited to cropland and pasture.

Where these soils are used as woodland, the hazard

of erosion, the equipment limitation, and seedling mortality are the major management concerns. Trees cannot be easily harvested on these soils. The slope restricts the use of tractors and skidders. Cable yarding systems are generally safer and result in less surface disturbance. Planting containerized nursery stock and controlling competing vegetation increase the seedling survival rate. Because of the slope, hand planting is necessary. Reinforcement planting may be needed.

Because of the slope, these soils are unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Plainfield soil is 8R, and that assigned to the Perrinton soil is 4R. The Michigan soil management groups are 5.3a and 1.5a.

111B—Plainfield sand, banded substratum, 0 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on outwash plains. Individual areas are irregular in shape and range from 15 to 200 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The upper part of the underlying material extends to a depth of about 60 inches. It is very pale brown, loose sand. The lower part to a depth of 180 inches is very pale brown, loose sand that has thin lamellae of yellowish brown and brown loamy sand and sandy loam. In some areas mottles are within a depth of 30 inches. In other areas the subsoil is fine sand.

Included with this soil in mapping are small areas of the excessively drained Coloma, somewhat excessively drained Toogood, and excessively drained Grattan soils. These soils are in landscape positions similar to those of the Plainfield soil. Coloma soils have lamellae of loamy sand within a depth of 60 inches. Toogood soils have gravelly layers within a depth of 40 inches. Grattan soils have a subsoil that is darker than that of the Plainfield soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Plainfield soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol is 3S. The Michigan soil management group is 5.3a.

111C—Plainfield sand, banded substratum, 6 to 18 percent slopes. This gently rolling and rolling, excessively drained soil is on the uneven side slopes of knolls and ridges on outwash plains. Individual areas are irregular in shape and range from 50 to 160 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The upper part of the underlying material extends to a depth of about 60 inches. It is very pale brown sand. The lower part to a depth of 180 inches is very pale brown, loose sand that has thin lamellae of yellowish brown and brown loamy sand and sandy loam. In some areas the subsoil has thin layers of loamy sand. In a few areas it is fine sand.

Included with this soil in mapping are small areas of the excessively drained Coloma, somewhat excessively drained Toogood, and excessively drained Grattan soils. These soils are in landscape positions similar to those of the Plainfield soil. Coloma soils have lamellae of loamy sand within a depth of 60 inches. Toogood soils have gravelly layers within a depth of 40 inches. Grattan soils have a subsoil that is darker than that of the Plainfield soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Plainfield soil, and the available water capacity is low. Surface runoff is slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is fairly well suited to building site development and poorly suited to septic tank absorption

fields. The slope is a limitation on sites for buildings. A poor filtering capacity and the slope are limitations on sites for septic tank absorption fields. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIIs. The woodland ordination symbol is 3S. The Michigan soil management group is 5.3a.

112B—Plainfield sand, wet substratum, 0 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on outwash plains. Individual areas are irregular in shape and range from 2 to 600 acres in size.

Typically, the surface layer is black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The upper part of the underlying material extends to a depth of about 60 inches. It is very pale brown sand. The lower part to a depth of 180 inches is very pale brown, mottled sand. In some areas the subsoil is fine sand.

Included with this soil in mapping are small areas of the excessively drained Coloma, somewhat excessively drained Toogood, and excessively drained Grattan soils. These soils are in landscape positions similar to those of the Plainfield soil. Coloma soils have lamellae of loamy sand within a depth of 60 inches. Toogood soils have gravelly layers within a depth of 40 inches. Grattan soils have a subsoil that is darker than that of the Plainfield soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Plainfield soil, and the available water capacity is low. Surface runoff is very slow. The water table is at a depth of 6 to 15 feet throughout the growing season.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol is 3S. The Michigan soil management group is 5.3a.

115B—Plainfield, banded substratum-Plainfield, loamy substratum, complex, 0 to 6 percent slopes. These nearly level to gently sloping, excessively drained soils are on outwash plains and moraines. Individual areas are irregular in shape and range from 15 to 200 acres in size. They are 60 to 85 percent the Plainfield soil that has a banded substratum and 20 to 30 percent the Plainfield soil that has a loamy substratum. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Plainfield soil that has a banded substratum has a surface layer of black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The upper part of the underlying material extends to a depth of about 60 inches. It is very pale brown sand. The lower part to a depth of 180 inches is very pale brown sand that has thin lamellae of yellowish brown and brown loamy sand and sandy loam. In some areas the subsoil is fine sand.

Typically, the Plainfield soil that has a loamy substratum has a surface layer of black sand about 2 inches thick. The subsoil is dark brown and strong brown, loose sand about 25 inches thick. The upper part of the underlying material extends to a depth of about 60 inches. It is very pale brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown, friable sandy clay loam 4 to 18 inches thick. In some areas the subsoil is fine sand.

Included with these soils in mapping are small areas of the excessively drained Coloma, somewhat excessively drained Toogood, and excessively drained Grattan soils. These soils are in landscape positions similar to those of the Plainfield soils. Coloma soils have lamellae of loamy sand within a depth of 60 inches. Toogood soils have gravelly layers within a depth of 40 inches. Grattan soils have a subsoil that is darker than that of the Plainfield soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in both of the Plainfield soils, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major

management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

These soils are well suited to building site development. They are poorly suited to septic tank absorption fields because of a poor filtering capacity. They readily absorb but do not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is IVs. The woodland ordination symbol assigned to the Plainfield soil that has a banded substratum is 3S, and that assigned to the Plainfield soil that has a loamy substratum is 8S. The Michigan soil management group is 5.3a.

121B—Grattan sand, banded substratum, 0 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on the tops and side slopes of knolls and ridges on outwash plains. Individual areas are irregular in shape and range from 3 to 330 acres in size.

Typically, the surface layer is black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has thin lamellae of yellowish brown and brown loamy sand and sandy loam. In some areas the subsoil is fine sand. In other areas it is a lighter shade of brown and does not have chunks of brittle material.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soils. These soils are in small depressions. Also included are small areas of the excessively drained Coloma and somewhat excessively drained Toogood soils. These soils are in landscape positions similar to those of the Grattan soil. Coloma soils have strata of loamy sand within a depth of 60 inches. Toogood soils have gravelly layers within a depth of 40 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol is 4S. The Michigan soil management group is 5.3a.

121C—Grattan sand, banded substratum, 6 to 18 percent slopes. This gently rolling and rolling, excessively drained soil is on the side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 10 to 400 acres in size.

Typically, the surface layer is black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has thin lamellae of yellowish brown and brown loamy sand and sandy loam. In some areas the subsoil is fine sand. In other areas it is a lighter shade of brown and does not have chunks of brittle material.

Included with this soil in mapping are small areas of the somewhat poorly drained Pipestone soils. These soils are in small depressions. Also included are small areas of the excessively drained Coloma and somewhat excessively drained Toogood soils. These soils are in landscape positions similar to those of the Grattan soil. Coloma soils have strata of loamy sand within a depth of 60 inches. Toogood soils have gravelly layers within a depth of 40 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled

equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, this soil is only fairly well suited to building site development. It is poorly suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIIs. The woodland ordination symbol is 4S. The Michigan soil management group is 5.3a.

122B—Grattan sand, wet substratum, 0 to 6 percent slopes. This nearly level to gently sloping, excessively drained soil is on outwash plains. Individual areas are irregular in shape and range from 10 to 600 acres in size.

Typically, the surface layer is black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown, mottled sand. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Included with this soil in mapping are small areas of the excessively drained Coloma, somewhat excessively drained Toogood, and excessively drained Plainfield soils. These soils are in landscape positions similar to those of the Grattan soil. Coloma soils have strata of loamy sand within a depth of 60 inches. Toogood soils have gravelly layers within a depth of 40 inches. The surface layer and subsurface layer of Plainfield soils are thinner than those of the Grattan soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is very slow. The water table is at a depth of 6 to 15 feet throughout the growing season.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soil is moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

This soil is well suited to building site development. It is poorly suited to septic tank absorption fields because of a poor filtering capacity. It readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol is 4S. The Michigan soil management group is 5.3a.

125B—Grattan, banded substratum-Spinks complex, 0 to 6 percent slopes. These nearly level to undulating soils are on the tops and side slopes of knolls and ridges on moraines. Individual areas are irregular in shape and range from 5 to 410 acres in size. They are 45 to 65 percent excessively drained Grattan soil and 30 to 40 percent well drained Spinks soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown sandy clay loam 4 to 18 inches thick. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other places it is fine sand.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand. In places the subsoil is mottled.

Included with these soils in mapping are small areas of Marlette, Toogood, and Scalley soils. These included soils are in landscape positions similar to those of the Grattan and Spinks soils. Marlette soils are loamy throughout. Toogood soils have gravel in the lower part.

Scalley soils are loamy in the upper part. Included soils make up 10 to 20 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is very slow.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns in areas of the Grattan soil. There are no major management concerns in areas of the Spinks soil. Loose sand in heavily traveled areas of the Grattan soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

These soils are well suited to building site development and fairly well suited to septic tank absorption fields. The Grattan soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol assigned to the Grattan soil is 4S, and that assigned to the Spinks soil is 4A. The Michigan soil management groups are 5.3a and 4a.

125C—Grattan, banded substratum-Spinks complex, 6 to 18 percent slopes. These gently rolling and rolling soils are on knolls and ridges and in convex areas on moraines. Individual areas are irregular in shape and range from 2 to 100 acres in size. They are 45 to 55 percent excessively drained Grattan soil and 35 to 45 percent well drained Spinks soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown, friable sandy clay loam 4 to 18 inches thick. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other places it is fine sand.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand.

Included with these soils in mapping are small areas of Marlette, Toogood, and Scalley soils. These included soils are in landscape positions similar to those of the Grattan and Spinks soils. Marlette soils are loamy throughout. Toogood soils have gravel in the lower part. Scalley soils are loamy in the upper part. Included soils make up 10 to 25 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is slow.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns in areas of the Grattan soil. There are no major management concerns in areas of the Spinks soil. Loose sand in heavily traveled areas of the Grattan soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

These soils are only fairly well suited to building site development because of the slope and to septic tank absorption fields because of the slope and a poor filtering capacity in the Grattan soil. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The Grattan soil readily absorbs but does not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Grattan soil is 4S, and that assigned to the Spinks soil is 4A. The Michigan soil management groups are 5.3a and 4a.

125E—Grattan, banded substratum-Spinks complex, 18 to 30 percent slopes. These hilly and steep soils are on moraines. Individual areas are irregular in shape and range from 5 to 40 acres in size. They are 45 to 55 percent excessively drained Grattan soil and 35 to 45 percent well drained Spinks soil.

These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown sandy clay loam 4 to 18 inches thick. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other places it is fine sand.

Typically, the Spinks soil has a surface layer of dark brown loamy sand about 11 inches thick. The subsurface layer is yellowish brown and brownish yellow, loose sand about 16 inches thick. The subsoil to a depth of 60 inches is brownish yellow and yellowish brown, loose sand that has thin lamellae of strong brown and brown, very friable loamy sand.

Included with these soils in mapping are small areas of Marlette, Toogood, and Scalley soils. These included soils are in landscape positions similar to those of the Grattan and Spinks soils. Marlette soils are loamy throughout. Toogood soils have gravel in the lower part. Scalley soils are loamy in the upper part. Included soils make up 10 to 25 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is medium.

Permeability is moderately rapid in the Spinks soil, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. The hazard of erosion, the equipment limitation, and seedling mortality on the Grattan soil are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Seeding logging roads, skid trails, and landings after the trees are logged helps to prevent excessive erosion. Because of the slope and loose sand, special care is needed in laying out logging roads and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible. Because of droughtiness in the Grattan soil, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist and planting containerized seedlings or special nursery stock reduce the seedling mortality rate. Harvest methods that leave some mature trees to provide shade and protection from the wind also reduce the mortality rate. Because of the slope, hand planting may be necessary.

Because of the slope, these soils are generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol is 4R. The Michigan soil management groups are 4a and 5.3a.

130B—Grattan-Coloma complex, 0 to 6 percent slopes. These nearly level to gently sloping, excessively drained soils are on the tops and side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 5 to 800 acres in size. They are 45 to 55 percent Grattan soil and 40 to 50 percent Coloma soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The underlying material to a depth of 60 inches is strong brown sand. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Typically, the Coloma soil has a surface layer of black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the subsoil has no lamellae. In other places the total thickness of the lamellae of loamy sand is more than 6 inches. In some areas the soil is fine sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Pipestone soils. These included soils are in small depressions. They make up as much as 5 percent of the unit.

Permeability is rapid in the Grattan and Coloma soils, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can

reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

These soils are well suited to building site development. They are poorly suited to septic tank absorption fields because of a poor filtering capacity. They readily absorb but do not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol assigned to the Grattan soil is 9S, and that assigned to the Coloma soil is 2S. The Michigan soil management groups are 5.3a and 5a.

130C—Grattan-Coloma complex, 6 to 18 percent slopes. These gently rolling and rolling, excessively drained soils are on the tops and side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 3 to 100 acres in size. They are 45 to 55 percent Grattan soil and 40 to 50 percent Coloma soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The underlying material to a depth of 60 inches is strong brown sand. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Typically, the Coloma soil has a surface layer of black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the subsoil has no lamellae. In other places the total thickness of the lamellae of loamy sand is more than 6 inches. In some areas the soil is fine sand.

Included with these soils in mapping are small areas of the well drained Metea soils on the tops of knolls and ridges. These included soils are loamy in the lower part of the subsoil and are less droughty than the Grattan and Coloma soils. Also included are small areas of Toogood soils. These soils have gravel in the lower part. They are in landscape positions similar to those of the Coloma and Grattan soils. Included soils make up less than 20 percent of the unit.

Permeability is rapid in the Grattan and Coloma soils, and the available water capacity is low. Surface runoff is slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, these soils are only fairly well suited to building site development. They are poorly suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soils readily absorb but do not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Grattan soil is 9S, and that assigned to the Coloma soil is 2R. The Michigan soil management groups are 5.3a and 5a.

130E—Grattan-Coloma complex, 18 to 30 percent slopes. These hilly and steep, excessively drained soils are on the tops and side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 10 to 80 acres in size. They are 45 to 55 percent Grattan soil and 40 to 50 percent Coloma soil. These soils occur as areas so intricately mixed or so small in size that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The underlying material to a depth of 60 inches is strong brown sand. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Typically, the Coloma soil has a surface layer of black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the subsoil has no lamellae. In other places the total thickness of the lamellae of loamy sand is more than 6 inches. In some areas the soil is fine sand.

Included with these soils in mapping are small areas of the well drained Metea soils on the tops of knolls and

ridges. These included soils are loamy in the lower part of the subsoil and are less droughty than the Coloma and Grattan soils. Also included are small areas of Toogood soils. These soils have gravel in the lower part. They are in landscape positions similar to those of the Coloma and Grattan soils. Included soils make up less than 10 percent of the unit.

Permeability is rapid in the Grattan and Coloma soils, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. The hazard of erosion, the equipment limitation, and seedling mortality are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Because of the slope and loose sand, special care is needed in laying out logging roads and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible. Because of droughtiness in the Grattan soil, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, these soils are generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Grattan soil is 9R, and that assigned to the Coloma soil is 2R. The Michigan soil management groups are 5.3a and 5a.

131B—Grattan, banded substratum-Coloma complex, 0 to 6 percent slopes. These nearly level to gently sloping, excessively drained soils are on the tops and side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 20 to 290 acres in size. They are 45 to 55 percent Grattan soil and 40 to 50 percent Coloma soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown, friable sandy clay loam 4 to 18 inches thick. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other places it is fine sand. In some areas mottles are within a depth of 30 inches.

Typically, the Coloma soil has a surface layer of black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the subsoil has no lamellae. In other places the total thickness of the lamellae of loamy sand is more than 6 inches. In some areas the soil is fine sand.

Included with these soils in mapping are small areas of the somewhat poorly drained Pipestone soils. These included soils are in small depressions. They make up about 5 percent of the unit.

Permeability is rapid in the Grattan and Coloma soils, and the available water capacity is low. Surface runoff is very slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

These soils are well suited to building site development. They are poorly suited to septic tank absorption fields because of a poor filtering capacity. They readily absorb but do not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIs. The woodland ordination symbol assigned to the Grattan soil is 4S, and that assigned to the Coloma soil is 2S. The Michigan soil management groups are 5.3a and 5a.

131C—Grattan, banded substratum-Coloma complex, 6 to 18 percent slopes. These gently rolling and rolling, excessively drained soils are on the tops and side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 5 to 280 acres in size. They are 45 to 55 percent Grattan soil and 40 to 50 percent Coloma soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is

brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown sandy clay loam 4 to 18 inches thick. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other places it is fine sand.

Typically, the Coloma soil has a surface layer of black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the subsoil has no lamellae. In other places the total thickness of the lamellae of loamy sand is more than 6 inches. In some areas the soil is fine sand.

Included with these soils in mapping are small areas of the well drained Metea soils on the tops of knolls and ridges. These included soils are loamy in the lower part of the subsoil and are less droughty than the Coloma and Grattan soils. Also included are small areas of Toogood soils. These soils have gravel within a depth of 40 inches. They are in landscape positions similar to those of the Coloma and Grattan soils. Included soils make up less than 20 percent of the unit.

Permeability is rapid in the Grattan and Coloma soils, and the available water capacity is low. Surface runoff is slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns. Loose sand in heavily traveled areas can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, these soils are only fairly well suited to building site development. They are poorly suited to septic tank absorption fields because of the slope and a poor filtering capacity. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. The soils readily absorb but do not adequately filter the effluent in the absorption fields. The poor filtering capacity can result in the pollution of ground water.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Grattan soil is 4S, and that assigned to the Coloma soil is 2S. The Michigan soil management groups are 5.3a and 5a.

131E—Grattan, banded substratum-Coloma complex, 18 to 30 percent slopes. These hilly and steep, excessively drained soils are on the tops and side slopes of knolls and ridges on outwash plains and moraines. Individual areas are irregular in shape and range from 5 to 55 acres in size. They are 45 to 55 percent Grattan soil and 40 to 50 percent Coloma soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown sandy clay loam 4 to 18 inches thick. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other places it is fine sand.

Typically, the Coloma soil has a surface layer of black sand about 3 inches thick. The subsurface layer is brown and yellow sand about 40 inches thick. Below this to a depth of 60 inches is very pale brown, loose sand that has thin lamellae of yellowish red, loose loamy sand. In some places the subsoil has no lamellae. In other places the total thickness of the lamellae of loamy sand is more than 6 inches. In some areas the soil is fine sand.

Included with these soils in mapping are small areas of the well drained Metea soils on the tops of knolls and ridges. These included soils are loamy in the lower part of the subsoil and are less droughty than the Coloma and Grattan soils. Also included are small areas of Toogood soils. These soils have gravel within a depth of 40 inches. They are in landscape positions similar to those of the Coloma and Grattan soils. Included soils make up less than 10 percent of the unit.

Permeability is rapid in the Coloma and Grattan soils, and the available water capacity is low. Surface runoff is medium.

Most areas are used as woodland. The hazard of erosion, the equipment limitation, and seedling mortality are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping

road surfaces, and culverts. Because of the slope and loose sand, special care is needed in laying out logging roads and in operating logging equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible. Because of droughtiness in the Grattan soil, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, these soils are generally unsuited to building site development and septic tank absorption fields.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Grattan soil is 4R, and that assigned to the Coloma soil is 2R. The Michigan soil management groups are 5.3a and 5a.

135B—Grattan, banded substratum-Metea complex, 0 to 6 percent slopes. These nearly level to undulating soils are on moraines. Individual areas are irregular in shape and range from 5 to 400 acres in size. They are 45 to 65 percent excessively drained Grattan soil and 30 to 40 percent well drained Metea soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown sandy clay loam 4 to 18 inches thick. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other areas it is fine sand. In some areas mottles are within a depth of 30 inches.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable loamy sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Included with these soils in mapping are small areas of Marlette, Toogood, and Scalley soils. These included soils are in landscape positions similar to those of the Grattan and Metea soils. Marlette soils are loamy throughout. Toogood soils have gravel within a depth of 40 inches. Scalley soils are loamy in the upper part. Included soils make up 10 to 25 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is very slow.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns in areas of the Grattan soil. There are no major management concerns in areas of the Metea soil. Loose sand in heavily traveled areas of the Grattan soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

These soils are well suited to building site development and fairly well suited to septic tank absorption fields. The Grattan soil is better suited to septic tank absorption fields than the Metea soil, which is limited by the moderately slow permeability in the lower part of the profile.

The land capability classification is VIs. The woodland ordination symbol assigned to the Grattan soil is 4S, and that assigned to the Metea soil is 4A. The Michigan soil management groups are 5.3a and 4/2a.

135C—Grattan, banded substratum-Metea complex, 6 to 18 percent slopes. These gently rolling and rolling soils are on moraines. Individual areas are irregular in shape and range from 5 to 700 acres in size. They are 45 to 60 percent excessively drained Grattan soil and 30 to 50 percent well drained Metea soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown, friable sandy clay loam 4 to 18

inches thick. In some places the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other places it is fine sand.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable loamy sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Included with these soils in mapping are small areas of Marlette, Toogood, and Scalley soils. These included soils are in landscape positions similar to those of the Grattan and Metea soils. Marlette soils are loamy throughout. Toogood soils have gravel within a depth of 40 inches. Scalley soils are loamy in the upper part. Included soils make up 10 to 25 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is slow.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as woodland. The equipment limitation and seedling mortality are the major management concerns in areas of the Grattan soil. There are no major management concerns in areas of the Metea soil. Loose sand in heavily traveled areas of the Grattan soil can interfere with the traction of wheeled equipment, especially during dry periods. Logging roads should be stabilized. Because of droughtiness, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

These soils are fairly well suited to building site development and septic tank absorption fields. The Grattan soil is better suited to septic tank absorption fields than the Metea soil, which is limited by the moderately slow permeability in the lower part of the profile. The slope is the major management concern. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly.

The land capability classification is VIIs. The woodland ordination symbol assigned to the Grattan soil is 4S, and that assigned to the Metea soil is 4A. The Michigan soil management groups are 5.3a and 4/2a.

135E—Grattan, banded substratum-Metea complex, 18 to 30 percent slopes. These hilly and steep soils are on moraines. Individual areas are irregular in shape and range from 5 to 800 acres in size. They are 45 to 55 percent excessively drained Grattan soil and 35 to 45 percent well drained Metea soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown sandy clay loam 4 to 18 inches thick. In places the subsoil is a lighter shade of brown and does not have chunks of brittle material.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable loamy sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the sandy material is more than 40 inches thick.

Included with these soils in mapping are small areas of Marlette, Toogood, and Scalley soils. These included soils are in landscape positions similar to those of the Grattan and Metea soils. Marlette soils are loamy throughout. Toogood soils have gravel within a depth of 40 inches. Scalley soils are loamy in the upper part. Included soils make up 10 to 25 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is medium.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as woodland. The hazard of erosion, the equipment limitation, and seedling mortality on the Grattan soil are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Seeding logging roads, skid trails, and landings after the trees are logged helps to prevent excessive erosion. Because of the slope and loose sand, special care is needed in laying out logging roads and in operating logging

equipment. Logging roads should be designed so that they conform to the topography. The grade should be kept as low as possible. Because of droughtiness in the Grattan soil, loss of planted or natural tree seedlings can be as high as 25 to 50 percent. Planting when the soils are moist can reduce the seedling mortality rate. Planting containerized seedlings or special nursery stock also reduces the mortality rate.

Because of the slope, these soils are unsuited to building site development and septic tank absorption fields. Better suited sites generally are nearby.

The land capability classification is VIIs. The woodland ordination symbol is 4R. The Michigan soil management groups are 5.3a and 4/2a.

135F—Grattan, banded substratum-Metea complex, 30 to 60 percent slopes. These steep and very steep soils are on moraines. Individual areas are irregular in shape and range from 2 to 65 acres in size. They are 45 to 55 percent excessively drained Grattan soil and 35 to 45 percent well drained Metea soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Grattan soil has a surface layer of black sand about 4 inches thick. The subsurface layer is brown sand about 2 inches thick. The subsoil is about 14 inches of dark brown, loose sand that has a few chunks of brittle material. The upper part of the underlying material extends to a depth of about 60 inches. It is strong brown sand. The lower part to a depth of 180 inches is very pale brown sand that has bands of dark brown sandy clay loam 4 to 18 inches thick. In some areas the subsoil is a lighter shade of brown and does not have chunks of brittle material. In other areas it is fine sand.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable loamy sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the sandy material is more than 40 inches thick.

Included with these soils in mapping are small areas of Marlette, Toogood, and Scalley soils. These included soils are in landscape positions similar to those of the Grattan and Metea soils. Marlette soils are loamy throughout. Toogood soils have gravel within a depth of 40 inches. Scalley soils are loamy in the upper part. Included soils make up 10 to 20 percent of the unit.

Permeability is rapid in the Grattan soil, and the available water capacity is low. Surface runoff is medium.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as woodland. The hazard of erosion and the equipment limitation are the major management concerns. Because of the hazard of erosion, logging roads, skid trails, and landings should be established on gentle grades and water should be removed by water bars, out-sloping road surfaces, and culverts. Seeding logging roads, skid trails, and landings after the trees are logged helps to prevent excessive erosion. The slope restricts the use of wheeled and tracked skidding equipment. Cable yarding systems generally are safer and result in less surface disturbance.

Because of the slope, these soils are generally unsuited to septic tank absorption fields and building site development.

The land capability classification is VIIs. The woodland ordination symbol is 4R. The Michigan soil management groups are 5.3a and 4/2a.

137B—Metea-Tustin complex, 0 to 6 percent slopes. These nearly level to undulating, well drained soils are on till plains. Individual areas are irregular in shape and range from 5 to 50 acres in size. They are 45 to 65 percent Metea soil and 30 to 40 percent Tustin soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable loamy sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Typically, the Tustin soil has a surface layer of very dark grayish brown loamy sand about 6 inches thick. The subsurface layer is light brown loamy sand about 1 inch thick. The upper part of the subsoil is strong brown, very friable loamy sand about 14 inches thick. The lower part is brown, firm silty clay loam about 15 inches thick. The underlying material to a depth of 60 inches is brown, mottled silty clay loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Included with these soils in mapping are small areas of the somewhat poorly drained Cosad and well drained Spinks and Perrinton soils. Perrinton soils are loamy throughout. They are on the side slopes of drainageways and depressions or in landscape

positions similar to those of the Metea and Tustin soils. Cosad soils are in depressions. Spinks soils are sandy throughout. They are on the tops of some knolls and ridges. Included soils make up 5 to 25 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Permeability is rapid in the upper part of the Tustin soil and slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as woodland. No major hazards or limitations affect the use of these soils as woodland.

Because of the shrink-swell potential, the Tustin soil is only fairly well suited to buildings with basements. Widening the foundation trenches and then backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Subsurface drains also help to prevent this damage. The soils are generally unsuited to septic tank absorption fields because of the moderately slow or slow permeability. Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Metea soil is 4A, and that assigned to the Tustin soil is 3A. The Michigan soil management groups are 4/2a and 4/1a.

137C—Metea-Tustin complex, 6 to 18 percent slopes. These gently rolling and rolling, well drained soils are on moraines. Individual areas are irregular in shape and range from 5 to 210 acres in size. They are 45 to 65 percent Metea soil and 30 to 40 percent Tustin soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable loamy sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the sandy material is more than 40 inches thick.

Typically, the Tustin soil has a surface layer of very dark grayish brown loamy sand about 6 inches thick. The subsurface layer is light brown loamy sand about 1 inch thick. The upper part of the subsoil is strong brown, very friable loamy sand about 14 inches thick. The lower part is brown, firm silty clay loam about 15 inches thick. The underlying material to a depth of 60 inches is brown, mottled silty clay loam. In some places the subsoil is mottled. In other places the sandy material is more than 40 inches thick.

Included with these soils in mapping are small areas of the somewhat poorly drained Cosad and well drained Spinks and Perrinton soils. Perrinton soils are loamy throughout. They are on the side slopes of drainageways and depressions or in landscape positions similar to those of the Metea and Tustin soils. Cosad soils are in depressions. Spinks soils are sandy throughout. They are on the tops of some knolls and ridges. Included soils make up 5 to 25 percent of the unit.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Permeability is rapid in the upper part of the Tustin soil and slow in the lower part. The available water capacity is moderate. Surface runoff is medium.

Most areas are used as woodland. No major hazards or limitations affect the use of these soils as woodland.

Because of the shrink-swell potential, the Tustin soil is only fairly well suited to buildings with basements. Widening the foundation trenches and then backfilling with suitable coarse textured material help to prevent the structural damage caused by shrinking and swelling. Subsurface drains also help to prevent this damage. The soils are generally unsuited to septic tank absorption fields because of the moderately slow or slow permeability. Enlarging or pressurizing the absorption field or installing alternating drain fields helps to overcome the restricted permeability. Land shaping and installing the distribution lines on the contour help to ensure that the absorption fields function properly.

The land capability classification is IVe. The woodland ordination symbol assigned to the Metea soil is 4A, and that assigned to the Tustin soil is 3A. The Michigan soil management groups are 4/2a and 4/1a.

147C—Marlette-Metea complex, 0 to 18 percent slopes. These nearly level to rolling, well drained soils are on till plains and moraines. Individual areas are irregular in shape and range from 10 to 80 acres in size. They are 30 to 50 percent Marlette soil and 30 to 50 percent Metea soil. These soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Marlette soil has a surface layer of dark grayish brown loam about 10 inches thick. The next layer is brown and pale brown, friable loam about 8 inches thick. The subsoil is brown, firm clay loam about

11 inches thick. The underlying material to a depth of 60 inches is yellowish brown loam. In some areas sand is below a depth of 40 inches.

Typically, the Metea soil has a surface layer of very dark grayish brown loamy sand about 8 inches thick. The subsurface layer is strong brown and pale brown, very friable sand about 24 inches thick. The subsoil is brown, firm clay loam about 16 inches thick. The underlying material to a depth of 60 inches is brown loam. In places the sandy material is more than 40 inches thick.

Included with these soils in mapping are small areas of the somewhat poorly drained Capac and well drained Scalley soils. Capac soils are loamy throughout. They are in drainageways and depressions. Scalley soils are loamy in the upper part and sandy in the lower part. They can occur anywhere in the unit, except for drainageways and depressions. Included soils make up 5 to 25 percent of the unit.

Permeability is moderately slow in the Marlette soil, and the available water capacity is high. Surface runoff is medium.

Permeability is rapid in the upper part of the Metea soil and moderately slow in the lower part. The available water capacity is moderate. Surface runoff is slow.

Most areas are used as woodland. No major hazards or limitations affect the use of these soils as woodland.

Because of the slope, these soils are only fairly well suited to building site development. Buildings should be designed so that they conform to the natural slope of the land. In some areas land shaping is necessary. The soils are poorly suited to septic tank absorption fields because of the slope and the moderately slow permeability in the loamy subsoil. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Special construction methods, such as enlarging the absorption fields or installing alternating drain fields, help to overcome the moderately slow permeability.

The land capability classification is IIIe. The woodland ordination symbol assigned to the Marlette soil is 3A, and that assigned to the Metea soil is 4A. The Michigan soil management groups are 2.5a and 4/2a.

181—Histosols, dysic. These nearly level, very poorly drained soils are in bogs on outwash plains and lake plains. They are subject to ponding. Slope ranges from 0 to 2 percent. Individual areas are round, elongated, or irregularly shaped and range from 2 to 300 acres in size.

Typically, the surface layer is yellowish brown peat about 6 inches thick. The next 10 inches is dark brown and dark reddish brown muck. Below this to a depth 60 inches is brown sand.

Permeability is moderately slow to moderately rapid, and the available water capacity is very high. Surface runoff is very slow or ponded. The seasonal high water table is near or above the surface in fall, winter, and spring and during excessively wet periods.

Most areas support native vegetation, which consists of sphagnum moss and blueberries.

Where these soils are used as woodland, the equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy harvesting equipment is limited by wetness and by low soil strength. Because of wetness, severe seedling mortality, and plant competition, trees are not planted on these soils. Because of the acidity and the wetness, tree growth and regeneration are very slow. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced.

Because of wetness, subsidence, and low strength, these soils are unsuited to septic tank absorption fields and building site development.

The land capability classification is VIw. No woodland ordination symbol is assigned. The Michigan soil management group is Mc-a.

182—Histosols, euic. These nearly level, very poorly drained soils are in depressions on lake plains and till plains. Slope ranges from 0 to 2 percent. Individual areas are irregularly shaped or oval and range from 2 to 400 acres in size.

Typically, the surface layer is black muck about 10 inches thick. The next 6 inches is black and very dark brown muck. Below this to a depth of 60 inches is brown sand.

Permeability is moderately slow to moderately rapid, and the available water capacity is high. Surface runoff is very slow. The seasonal high water table is near or above the surface during much of the year.

Most areas are used as woodland. The equipment limitation, seedling mortality, and the hazard of windthrow are the major management concerns. The use of heavy harvesting equipment is limited by wetness and by low soil strength. The equipment should be used only when the soils are frozen. Because of wetness, severe seedling mortality, and plant competition, trees are not planted on these soils. The hazard of windthrow can be reduced by harvest methods that do not isolate the remaining trees or leave them widely spaced. Windthrown trees should be periodically removed.

Because of wetness, subsidence, and low strength, these soils are unsuited to septic tank absorption fields

and building site development. Better suited sites generally are nearby.

The land capability classification is Vw. No woodland ordination symbol is assigned. The Michigan soil management group is Mc.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify as prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties *(18)*.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where wetness or firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Glen Lamberg, district conservationist, and Maya Hamady, soil conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 160,100 acres in Newaygo County, or 29 percent of the total acreage, is farmland. About 103,600 acres is used for crops and pasture. About 4,600 acres is used as permanent pasture. Most row crop rotations include several years of hay or pasture. As a result, the combined acreage of pasture and hayland in any one year is estimated to be about 56,000 acres. Of the total acreage of cropland, about 90,000 acres is used for row crops, 3,000 acres for orchards, and 6,000 acres for vegetable crops *(10)*. In 1986, about 25,000 acres was used for corn and 3,950 acres for small grain. An estimated 4,000 acres was used for Christmas tree farms.

The most common row crops that are suited to the soils and climate in Newaygo County are corn, dry beans, soybeans, and potatoes. The most common close-growing crops are oats and wheat. Rye, barley, and buckwheat are not so common, but they can be grown. Alfalfa and red clover grown in mixtures with grasses are the most common hay crops.

The main management needs on the cropland and pasture in the county are measures that help to control water erosion and soil blowing, reduce wetness, conserve soil moisture, and improve fertility and tilth.

Water erosion and soil blowing are major management concerns on most of the cropland in the county. Loss of the surface layer through erosion reduces the productivity of the soils. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Perrinton and Del Rey soils,

Figure 11.—Soil blowing in an area of Adrian muck.

and on soils that tend to be droughty, such as Spinks and Coloma soils. Erosion on farmland causes the sedimentation of streams. Controlling erosion minimizes this pollution and improves the quality of water for municipal and recreation uses and for fish and wildlife.

Water erosion is a serious hazard on all of the soils that have slopes of 2 percent or more. Preparing a good seedbed is difficult on some of the soils because the friable surface layer has been eroded away in places.

Erosion-control practices provide a protective cover, reduce the runoff rate, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the surface for extended periods reduces the susceptibility to erosion and preserves the productive capacity of the soil. On livestock farms, where pasture and hay are needed, including forage crops of grasses and legumes in the cropping sequence helps to control erosion in the more sloping areas, provides nitrogen for subsequent crops, and improves tilth. Conservation tillage helps to control runoff and erosion by leaving protective amounts of crop residue on the surface. Cover crops, diversions, and grassed waterways also help to control erosion.

Soil blowing is a hazard on the sandy Coloma, Plainfield, Spinks, Boyer, Metea, Cosad, and Selfridge soils and on the mucky Carlisle, Edwards, Linwood, and Adrian soils (fig. 11). It can damage these soils in a few hours, especially the mucky soils, if the wind is strong, the soils are dry, and the surface is bare. An adequate plant cover, surface mulch, wind stripcropping, and tillage methods that leave the surface rough help to control soil blowing. Wind barriers and conservation tillage also help to control soil blowing. Examples of wind barriers are stands of tall wheatgrass and windbreaks of trees and shrubs.

No-till farming, which is becoming increasingly common in the county, is effective in controlling water erosion and soil blowing because it leaves crop residue on the surface. It is suited to most of the soils in the county. It is not so successful, however, on soils that have a clayey surface layer. Because of no-till farming, erodible areas that otherwise are only marginally productive can be used for corn. No-till farming helps to maintain the productive capacity of nearly all cropland. In areas where no-till crops are grown, different methods of planting and of controlling insects and weeds are needed. The proper time for planting, the selection of herbicides that are suited to the existing vegetation, an adequate supply of plant nutrients, and

the selection of tillage systems based on soil characteristics are important management requirements.

Much of the permanent pasture in the county is in areas where erosion is a hazard. Controlling erosion is particularly important when the pasture is seeded. The number of livestock that the pasture supports, the length of time that they graze, and the distribution of rainfall influence forage production and the extent to which the plant cover protects the surface. Good pasture management includes stocking rates that maintain the key forage species, pasture rotation, deferred grazing, timely grazing, and strategically located water supplies for livestock.

Information about the design and application of erosion-control measures for each kind of soil is available in the local office of the Soil Conservation Service.

Soil drainage is a major management concern in many areas used for crops or pasture in the county. Draining cropland improves the air-water relationship in the root zone. In areas where drainage is poor, spring planting, spraying, and harvesting are delayed and controlling weeds is difficult. Properly designed subsurface drainage systems, surface drainage systems, or both, can be used to remove excess water.

Unless drained, Carlisle, Selfridge, Cohoctah, Del Rey, Capac, Parkhill, and Wauseon soils are naturally so wet that crops cannot be planted, must be planted late, or are damaged by water. A drainage system has lowered the water table in these soils so that the common field crops and specialty crops can be grown. Natural drainage is good in Marlette and Perrinton soils during most of the year, but these soils tend to dry slowly after rains. Small areas of somewhat poorly drained soils along drainageways and in swales are commonly included in some areas of these soils, especially where slopes are 1 to 6 percent. A drainage system is needed in some of these wetter areas.

The design of surface and subsurface drainage systems varies with the kind of soil. A combination of surface and subsurface drains is used in most areas of poorly drained and very poorly drained soils that are intensively row cropped. The drains are more closely spaced in slowly permeable soils than in the more permeable soils. Subsurface drainage is slow or very slow in Del Rey, Capac, Perrinton, and Wauseon soils. Adequate outlets for subsurface drainage systems are not readily available in many areas of Cohoctah, Adrian, Granby, Glendora, Carlisle, and Linwood soils. Diversions can be used to remove surface runoff from some wet areas. Good tilth and an ample supply of organic matter also improve drainage.

Organic soils oxidize and subside when the water in their pore space is replaced with air. As a result, special systems are needed to control the depth and period of drainage. Maintaining the water table at the level required by the crops during the growing season and raising it to the surface during other parts of the year minimize the oxidation and subsidence of these soils.

Information about the design of drainage systems for each kind of soil is available in the local office of the Soil Conservation Service.

Conserving soil moisture during dry periods is a management concern in areas of Coloma, Boyer, Toogood, Metea, Cosad, Selfridge, and Spinks soils. No-till farming and other kinds of conservation tillage that leave all or part of the crop residue on the surface can conserve soil moisture. Increasing the organic matter content increases the available water capacity. Irrigation, which improves productivity, may become more important in the county in the future. If properly managed, the droughty soils and many other soils in the county are suited to irrigation.

Soil fertility is naturally medium or high in loamy soils and low in most sandy soils on uplands. Soils on flood plains, such as Cohoctah and Ceresco soils, range from slightly acid to mildly alkaline and are naturally higher in content of plant nutrients than most soils on uplands.

Many sandy soils naturally range from strongly acid to slightly acid. If lime has never been applied on these soils, applications of ground limestone are needed to raise the pH level sufficiently for the production of alfalfa and other crops that grow well only on nearly neutral soils. Available phosphorus and potassium levels are naturally low or medium in most of these soils. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields *(11)*. If applied in excess of that needed by the crops, fertilizer can be leached into ground water or surface water. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer and lime needed.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous.

Some of the soils used for crops in the county have a loamy surface layer that is light in color and low in organic matter content. Generally, the structure of such soils is weak. A surface crust forms during periods of intensive rainfall. The crust hinders the emergence of plant seedlings, decreases the rate of water infiltration, and increases the runoff rate. Regular additions of crop residue, manure, and other organic material can improve tilth and can help to prevent surface crusting.

Maintaining good tilth is difficult in the finer textured Del Rey, Parkhill, and Wauseon soils because these

soils stay wet until late in spring. If plowed when wet, the soils tend to be very cloddy when dry and are compacted. As a result, preparing a good seedbed is difficult. Cover crops, green manure crops, proper management of crop residue, conservation tillage, and applications of livestock manure help to maintain or improve tilth and increase or maintain the organic matter content. Fall plowing and chisel plowing at the proper moisture content can help to prevent deterioration of tilth in nearly level, poorly drained or somewhat poorly drained soils. These measures also allow the soils to be tilled earlier the following spring. Fall plowing is not suitable on sloping soils or on soils that are subject to soil blowing. Good management is needed in intensively cropped areas and in areas that are cultivated year after year.

Livestock grazing on wet, loamy or clayey soils results in surface compaction and poor tilth. The compaction caused by grazing during wet periods retards the growth of pasture plants. Proper harvesting methods, such as those for hay or silage, improve plant growth and help to prevent compaction.

Specialty Crops

The variety of soils, topography, and climatic conditions in Newaygo County allows for the production of a wide variety of vegetable, berry, and fruit crops. The county is the top producer of onions and carrots in the state. Other vegetable crops include mint, asparagus, celery, squash, sweet corn, cucumbers, peppers, turnips, cabbage, cauliflower, tomatoes, melons, parsnips, snap beans, broccoli, and peas *(14)*. Most of the carrots, onions, celery, parsnips, and mint are grown east of the town of Grant, in the Rice Lake area. They are grown on organic soils that have been drained. Mucky soils are well suited to blueberries and a wide variety of vegetable crops, but a drainage system and protection from soil blowing are needed. Carlisle, Edwards, and Adrian soils are examples.

Berry crops, including strawberries, raspberries, and blueberries, are grown on approximately 400 acres in the county. Deep soils that are characterized by good natural drainage and that warm up early in spring are especially well suited to vegetables and small fruits. Examples are the Boyer, Spinks, Metea, and Toogood soils that have slopes of less than 6 percent. If irrigated, the Plainfield and Coloma soils that have slopes of less than 6 percent also are well suited to vegetables. Crops generally can be planted and harvested earlier on these soils than on other soils in the survey area.

Certain areas in the county, most notably those south of Hesperia in the western part, are especially well suited to fruit trees. The fruit grown in the county includes dwarf and standard apples, peaches, sweet and tart cherries, plums, pears, apricots, and nectarines. Some sites are better suited than others, mainly because of differences in air temperature and air drainage. Differences in air temperature are caused by variations in elevation and in the proximity to Lake Michigan.

Carefully selecting the sites used for fruit crops helps to ensure productivity. Agricultural records indicate that some sites are better suited to fruit production than others, mainly because of differences in the kind of soil and in air temperature. These differences can occur within short distances. Soil properties affect management practices, tree growth, and the productivity of the orchards. Local climatic conditions affect fruit-set, pollination by bees, the number of blossoms per tree, and frost damage to woody parts of the trees.

The latest information about growing specialty crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the

Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(23)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations or hazards, impractical to remove, that limit their use.

Class VI soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations or hazards that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Also given at the end of each map unit description is a Michigan soil management group. The soils are assigned to a group according to the dominant profile texture, the natural drainage class, and the major management concerns. For soils making up a complex, the management groups are listed in the same order as the series named in the complex. The local office of the Soil Conservation Service can provide further information about these groups.

Woodland Management and Productivity

Maya Hamady, soil conservationist, Soil Conservation Service, helped prepare this section.

Prior to settlement, forest vegetation covered a large part of Newaygo County. The sandy soils in the Toogood-Boyer association, which is described under the heading "General Soil Map Units," were covered with extensive stands of white pine and red pine. The droughtiest soils, such as those in the Plainfield-Grattan-Brems association, were covered with a mixed forest of jack pine and black oak. The more clayey and moister soils in the Marlette-Metea-Spinks association were covered with hardwood stands dominated by sugar maple and American beech. The associated species in these stands included yellow birch, elm, hemlock, and red oak. The well drained soils in the Coloma-Spinks-Metea association supported stands of maple and beech. The very poorly drained soils in the Adrian-Carlisle-Martisco association supported swamp forest vegetation consisting of northern whitecedar and tamarack. The moderately well drained to poorly drained soils in the Pipestone-Covert-Kingsville association were covered with lowland hardwoods, mainly silver maple, red maple, ash, and elm.

The once extensive forest was virtually all harvested by about 50 years after the first settlers arrived in the county in 1834. Repeated fires following logging burned

the organic matter in the sandier soils. As a result, the soils that once supported majestic white pine could only support the tree species that are tolerant of impoverished soils. Also, clear cutting of large areas favored sunlight-tolerant species, such as aspen and oak, which currently dominate the landscape.

Many of the soils that were cleared for farming were too droughty and low in fertility to support productive agriculture. These soils have reverted to Federal and State ownership as tax-delinquent lands. Currently, the Forest Service manages about 106,820 acres, or nearly 20 percent of the total acreage in the county. The State owns 1,900 acres in parks and roadways in the county.

Since the lands that were least suited to agriculture and had the poorest soils reverted to government agencies, the more productive timber sites in the county generally are privately owned. Most of the woodland in the county, whether private or public, is dominated by pole-size stands about 50 to 70 years old. The dominant forest types are oak, which covers about 34 percent of the total forested area, and aspen, which covers about 31 percent *(7, 17)*.

Growing Christmas trees is an important enterprise in the county. More than 6,000 acres in the county is used for Christmas trees. Many more areas could be used for these trees. The most common Christmas tree species are Scotch pine on the droughty, sandy soils and blue spruce and Douglas-fir on the loamy soils. Douglas-fir, white fir, and other specialty Christmas trees are grown in the southern and western parts of the county. These species are easily damaged by frost. They should be grown on north- and east-facing slopes, where early spring growth is less likely.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe*

indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to firm layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. The volume was determined through the use of standard yield tables *(25)*.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Table 9 gives information about operating harvesting or thinning equipment in logging areas and on skid trails, landings, and logging roads. Limitations are given for the most limiting season and for the preferred season. The *most limiting season* in Newaygo County generally is spring or late fall. In some areas, however, it is during dry periods in summer, when loose sand can limit trafficability on deep, well drained, sandy soils. The *preferred operating season* is the period when harvesting or thinning causes the least amount of damage to the soil. This period generally is when the soil is not too wet or when the ground is frozen or partly frozen.

In table 9, a rating of *slight* indicates that the use of conventional logging equipment is not restricted if normal logging methods are used. A rating of *moderate* indicates that the use of equipment is restricted because of one or more soil factors. If wetness is a limitation, high flotation equipment or special procedures may be needed to prevent the formation of ruts. A rating of *severe* indicates that the kind of equipment that can be used is seriously restricted.

Logging areas and skid trails include areas where some or all of the trees are being cut. Generally, equipment traffic is least intensive in the logging areas. Skid trails, which generally are within the logging areas, are roads or trails over which logs are dragged or hauled from the stump to a log landing.

Landings are areas where logs are assembled for transportation. Wheeled equipment may be used more frequently in these areas than in any other areas affected by logging.

Logging roads are access roads leading from primary or surfaced roads to the logging areas. The logging roads serve as transportation routes for wheeled logging equipment and logging trucks. Generally, they are unpaved roads. Some are graveled.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 10 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 10 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Maya Hamady, soil conservationist, Soil Conservation Service, helped prepare this section.

Cropland is mainly in the southern part of Newaygo County, and woodland is in the northern part. As a result, the county is considered the gateway to northern Michigan. The 106,820 acres in the Manistee National Forest, the 280 acres in Newaygo State Park, the 356 miles of rivers and streams, and the 234 lakes in the county provide ample opportunities for recreation. More than 35 miles of the North Country Trail is in the county. This is a national trail built across public and private land. It is 3,600 miles long. The national headquarters for the trail is in Lincoln Township.

Five natural preserves represent the types of vegetation in the county. They include areas of natural prairie vegetation and a natural wooded swamp. Sixteen historical sites in the county depict the logging era from the latter part of the last century to the beginning of this century. The sites include ghost towns, logging camps, and old-time sawmills. Historical Indian sites include burial mounds and campsites. Five scenic areas overlook river and stream valleys.

The county has numerous resorts, cabins, motels, and private and public campgrounds, mostly along the larger lakes. The public campgrounds are on Federal, State, county, and municipal lands. They include primitive tent campsites and trailer hookup sites.

Many of the opportunities for recreation in the county are provided by areas of water. The many lakes offer excellent opportunities for catching bluegill, sunfish, bass, and pike. Some lakes have been stocked with rainbow trout and brown trout. Many miles of streams offer prime opportunities for catching brook trout, rainbow trout, and brown trout. The Muskegon River and many other rivers have been stocked with walleye, chinook salmon, and coho salmon. Canoeing is popular on the Muskegon, Pere Marquette, and White Rivers. Powerboats can be used on the larger lakes. The county has canoe liveries and boat marinas.

The Newaygo County Parks Commission, in cooperation with the Manistee National Forest, provides miles of marked cross-country trails for skiing and snowmobiling. The privately developed recreational facilities in the county include horseback riding trails and golf courses.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 11, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 14 and interpretations for dwellings without basements and for local roads and streets in table 13.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have

moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Maya Hamady, soil conservationist, and Lynn Sampson, biologist, Soil Conservation Service, helped prepare this section. The sources of information about threatened species were Fred Ignatoski, wildlife biologist, Michigan Department of Natural Resources, Baldwin, Michigan; Dave Vandenbelt, Audubon Society, Fremont, Michigan; Michigan Natural Features Inventory; and U.S. Fish and Wildlife Service.

Prior to European settlement, many wildlife species inhabited the wilderness of Newaygo County. They included black bear, mountain lion, lynx, bobcat, elk, and timber wolf. The passenger pigeon and the eastern wild turkey were abundant in the pristine forests of the county. The passenger pigeon became extinct at the beginning of this century.

Since European settlement, human activities have significantly affected the composition of wildlife species in the county. In the 1800's, logging created conditions resembling those of a prairie. Many wildlife species associated with prairies increased in number or expanded their range from the west. The sharp-tailed grouse and the prairie chicken, which invaded the newly created prairie habitat, remained abundant as long as suitable habitat was available.

As the forest regenerated after it was logged, the population of white-tailed deer, which was relatively small in the pristine forest, soared in response to abundant browse. The timber wolf was replaced by the coyote, which is a more adaptable species. Most of the wildlife species that currently inhabit the county are adapted to second-growth forest, brushy edges, and agricultural areas.

The ring-necked pheasant was introduced in the newly created agricultural habitat. The eastern wild turkey was recently reintroduced into the county. Such species as the European starling, the Norway rat, and the house mouse were inadvertently introduced.

An area where farmland is interspersed with woodland is ideal habitat for white-tailed deer, which are very abundant in the county. The deer can increase to such a plentiful level during consecutive years of mild winters that they can cause damage to crops, tree seedlings, saplings, and other vegetation. Feeding the deer can help to maintain an artificially high population that exceeds the natural carrying capacity of the land and perpetuates the damage to vegetation.

The ring-necked pheasant is at the northern end of its range in Newaygo County. It can survive in areas of farmland if enough cover and food are provided in nearby areas. Providing undisturbed nesting cover of grasses and legumes is critical in maintaining the population of this species. The Sichuan pheasant, which is being studied by the Michigan Department of Natural Resources, might prove to be hardier than the ring-necked pheasant in this county.

Ruffed grouse in Newaygo County currently are more abundant than they were in the pristine forest because of the expansion of the aspen forest type. The population of this species fluctuates from year to year. The grouse generally favor aspen forest during winter and early spring because the catkins of the male flowers are high-energy food for this bird. Shrubs that provide small fruit, such as hawthorn, attract the grouse in fall and late summer. The grouse also use small openings in wooded areas, which provide forbs. Grouse broods use young, dense aspen stands. The slightly larger aspens are the best source of winter food. If properly managed, aspen stands can provide cover, food, and drumming sites for the ruffed grouse throughout the year.

Cottontail rabbits inhabit areas of cropland, farmsteads, and abandoned building sites and have adapted to municipal areas. Swampy areas in the northern part of the county provide habitat for snowshoe hare.

Fox squirrels inhabit nearly every hardwood woodlot on the farms in the county. They eat corn and thus thrive in agricultural areas. Gray squirrels and black squirrels inhabit the oak forests in the county. Red squirrels inhabit the pine forests and swampy areas.

Several species of furbearers, including mink, river otter, red fox, and gray fox, are abundant in the county. Pine martens have recently been reintroduced. As the forests mature, black bears are becoming more common. The hundreds of miles of wooded streams provide good habitat for beavers, the population of which currently is high in the county.

Much of the original wetland habitat in the county has already been drained. The remaining marshes and the areas that are subject to flooding in the county provide important habitat for a variety of waterfowl. Flooded areas of timber are good nesting sites for wood ducks. Nesting boxes provided in appropriate areas of the habitat have been responsible for a recent increase in the number of wood ducks. A few secluded lakes in the northern part of the county could provide habitat for common loons. Other species that reportedly have nested in the county are sandhill crane, upland plover, goshawk, red-shouldered hawk, and green heron.

The lakes and streams in Newaygo County provide habitat for many species of fish. Bass, various species of sunfish, and northern pike inhabit most of the lakes. A number of lakes have been stocked with rainbow

trout and walleye. Brown and rainbow trout and coho and chinook salmon have been stocked in the Muskegon River. The White River is considered one of the better streams for brook trout in Michigan.

The plant communities in Newaygo County include many species that the State of Michigan considers rare, threatened, or endangered. These species include false arrow feather (*Aristida necopino*), western silvery aster (*Aster sericeus*), prairiesmoke (*Geum triflorum*), and smallflower hemicarpha (*Hemicarpha micrantha*). The county also includes unique upland areas of prairie plant communities.

The bald eagle (*Hiliaeetus leucocephalus*), the Karner blue butterfly (*Lycaeides melissa samuelis*), and the lake sturgeon (*Acipenser fulvescens*) all inhabit the county. The U.S. Fish and Wildlife Service considers the bald eagle a threatened species. The Karner blue butterfly has been proposed for inclusion as an endangered species on the federal list of endangered and threatened species. The lake sturgeon is being studied for possible inclusion on the list.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, rye, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are goldenrod, white aster, stinging nettle, and cardinalflower.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, aspen, cherry, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, and cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, rushes, sedges, and reeds.

Shallow water areas have an average depth of less

than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include ring-necked pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, red fox, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 13 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies

may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by a firm, dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, and the available water capacity in the upper 40 inches affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 14 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 14 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel are less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 14 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1

or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 14 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, and soil reaction affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 15 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 15, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 16 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or of organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a

permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table and permeability of the aquifer. The content of large stones affects the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to a firm layer or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by the depth to a firm layer, large stones, slope, and the hazard of cutbanks caving. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones. The performance of a system is affected by the depth of the root zone and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, and slope affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

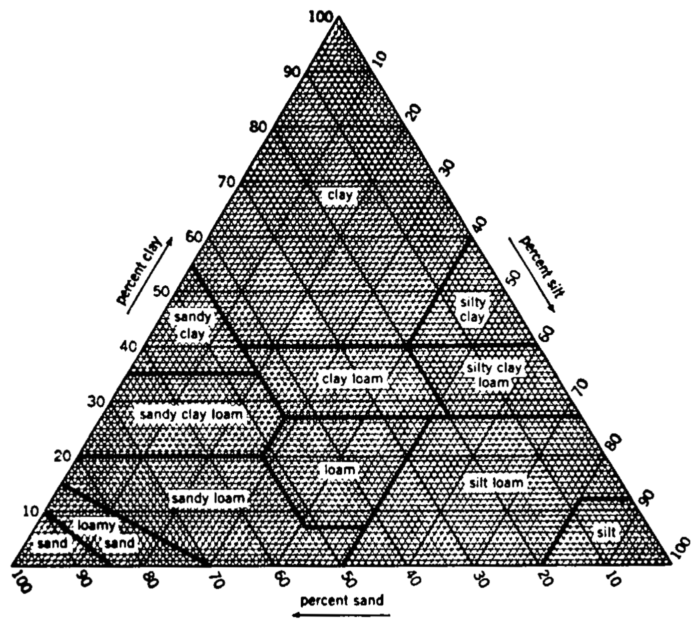

Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 17 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 12). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 18 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume

change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 18, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 19 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 19, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month; and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 19.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 19 shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of

corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(24)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is sandy, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(22)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(24)*. Unless otherwise stated, matrix colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Abscota Series

The Abscota series consists of moderately well drained, rapidly permeable soils on flood plains along streams and rivers. These soils formed in sandy alluvial deposits. Slope ranges from 0 to 3 percent.

Typical pedon of Abscota loamy sand, 0 to 3 percent slopes, 970 feet south and 1,850 feet east of the northwest corner of sec. 30, T. 11 N., R. 14 W., Bridgeton Township:

A—0 to 9 inches; dark brown (10YR 3/3) loamy sand, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; very friable; common fine and medium roots; slightly acid; abrupt wavy boundary.

Bw—9 to 16 inches; dark brown (7.5YR 4/4) loamy fine sand; weak very fine and fine subangular blocky structure; very friable; common fine roots; common fine and medium dark brown (10YR 3/3) root channels; slightly acid; abrupt wavy boundary.

C1—16 to 21 inches; stratified dark yellowish brown (10YR 4/4) and brownish yellow (10YR 6/6) sand; single grain; loose; common fine roots; slight effervescence; slightly alkaline; clear wavy boundary.

C2—21 to 48 inches; light yellowish brown (10YR 6/4) sand; common fine and medium prominent strong brown (7.5YR 5/8) mottles; single grain; loose; few fine roots; strata of dark brown (10YR 4/3) sand one-half inch thick; slight effervescence; slightly alkaline; clear wavy boundary.

C3—48 to 60 inches; very pale brown (10YR 7/3) sand; single grain; loose; neutral.

The solum is 16 to 43 inches thick. The content of gravel ranges from 0 to 10 percent in the solum and from 0 to 25 percent in the C horizon. The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. It is loamy fine sand, loamy sand, or sand. The C horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 3 to 6. In some pedons it has as much as 25 percent coarse sand.

Adrian Series

The Adrian series consists of very poorly drained soils in depressions on outwash plains, till plains, and moraines. These soils formed in herbaceous organic material 16 to 50 inches deep over sandy material. Permeability is moderately slow to moderately rapid in the organic material and rapid in the sandy material. Slope ranges from 0 to 2 percent.

Typical pedon of Adrian muck, 50 feet south and 2,350 feet west of the northeast corner of sec. 15, T. 13 N., R. 11 W., Big Prairie Township:

Oa1—0 to 5 inches; muck, black (10YR 2/1) broken face and rubbed; about 30 percent fiber, less than 10 percent rubbed; weak fine granular structure; many fine and medium roots; mainly herbaceous fibers; slightly acid; clear smooth boundary.

Oa2—5 to 19 inches; muck, black (10YR 2/1) broken face and rubbed; about 2 percent fiber, less than 1 percent rubbed; weak fine granular structure; mainly herbaceous fibers; slightly acid; abrupt smooth boundary.

Cg1—19 to 40 inches; light brownish gray (10YR 6/2) sand; single grain; loose; moderately alkaline; gradual smooth boundary.

Cg2—40 to 60 inches; gray (10YR 5/1), stratified loamy sand and sand; single grain; loose; about 10 percent gravel; moderately alkaline.

Depth to the Cg horizon ranges from 16 to 50 inches. The organic fibers are derived primarily from herbaceous plants, but some layers contain as much as 50 percent woody material. The Cg horizon is dominantly sand, loamy sand, or fine sand. In some pedons, however, it has thin strata of sandy loam. It has 0 to 15 percent gravel.

Algansee Series

The Algansee series consists of somewhat poorly drained, rapidly permeable soils that formed in sandy alluvium on flood plains. Slope ranges from 0 to 3 percent.

Typical pedon of Algansee loamy fine sand, 1,797 feet south and 969 feet east of the northwest corner of sec. 21, T. 11 N., R. 14 W., Bridgeton Township:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loamy fine sand, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few fine roots; few woody fragments; slightly alkaline; clear wavy boundary.

C1—7 to 12 inches; brown (10YR 5/3) loamy fine sand; weak medium granular structure; friable; few fine roots; few woody fragments; common medium faint dark grayish brown (10YR 4/2) organic stains; slightly alkaline; gradual wavy boundary.

C2—12 to 37 inches; very pale brown (10YR 7/3) fine sand; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; few woody fragments; few strata of grayish brown (10YR 5/2), dark reddish brown (5YR 2/2 and 3/4), and strong brown (7.5YR 5/8) fine sand one-quarter to one-half inch thick; slightly alkaline; clear wavy boundary.

Cg—37 to 60 inches; light gray (10YR 7/2) fine sand; common medium distinct yellowish brown (10YR 5/4) and brownish yellow (10YR 6/6) mottles; single grain; loose; dark grayish brown (10YR 4/2) organic stains; few strata of dark reddish brown (5YR 2/2 and 3/4) and strong brown (7.5YR 5/8) fine sand

one-quarter to one-half inch thick; moderately alkaline.

The Ap horizon has value of 3 or 4 and chroma of 1 or 2. The C horizon has value of 3 to 7 and chroma of 2 to 4. It is fine sand, sand, loamy fine sand, or loamy sand.

Boyer Series

The Boyer series consists of well drained soils on outwash plains. These soils formed in loamy and sandy deposits. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 40 percent.

Typical pedon of Boyer loamy sand, 0 to 6 percent slopes, 2,590 feet south and 1,980 feet west of the northeast corner of sec. 1, T. 11 N., R. 11 W., Ensley Township:

Ap—0 to 10 inches; dark brown (7.5YR 3/2) loamy sand, pinkish gray (7.5YR 6/2) dry; weak medium subangular blocky structure parting to moderate fine granular; very friable; few fine roots; about 1 percent gravel; slightly acid; abrupt smooth boundary.

Bw—10 to 18 inches; dark brown (7.5YR 4/4) loamy sand; moderate medium subangular blocky structure; very friable; few fine and medium roots; common dark brown (7.5YR 3/2) worm channels; about 4 percent gravel; neutral; clear smooth boundary.

2Bt—18 to 30 inches; reddish brown (5YR 4/4) gravelly sandy loam that in the lower part of the horizon has intermittent layers of gravelly sandy clay loam ½ to 1 inch thick; weak fine subangular blocky structure; friable; common faint clay films on faces of peds; some clay bridges between sand grains and small pebbles; few fine and medium roots; about 20 percent gravel and 2 percent cobbles; neutral; clear wavy boundary.

2C—30 to 60 inches; yellowish brown (10YR 5/6) gravelly coarse sand; single grain; loose; about 30 percent gravel; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The Ap horizon has hue of 7.5YR or 10YR and chroma of 2 or 3. The Bw horizon has hue of 7.5YR or 10YR. It is dominantly loamy sand, but the range includes loamy fine sand, fine sandy loam, and sandy loam. The 2Bt horizon has hue of 5YR, 7.5YR, or 10YR and chroma of 4 to 6. It is dominantly gravelly sandy loam, but the range includes gravelly sandy clay loam and sandy loam. The 2C horizon has value and chroma of 4 to 6. It is gravelly coarse sand, very gravelly sand, or gravelly sand.

Brems Series

The Brems series consists of moderately well drained, rapidly permeable soils on outwash plains and moraines. These soils formed in sandy deposits. Slope ranges from 0 to 4 percent.

These Brems soils in this county are taxadjuncts to the series because they do not have low-chroma mottles in the lower part of the B horizon. This difference, however, does not affect the use and management of the soils.

Typical pedon of Brems sand, 0 to 4 percent slopes, 1,300 feet north and 615 feet east of the southwest corner of sec. 7, T. 13 N., R. 12 W., Everett Township:

Oi—1 inch to 0; red pine needles.

Ap—0 to 8 inches; dark brown (10YR 3/3) sand, grayish brown (10YR 5/2) dry; moderate medium granular structure; very friable; many fine, common medium, and few coarse roots; about 1 percent gravel; strongly acid; abrupt smooth boundary.

Bw1—8 to 24 inches; strong brown (7.5YR 5/6) sand; few medium distinct yellowish red (5YR 5/8) mottles in the lower 2 inches of the horizon; weak medium subangular blocky structure; very friable; common fine to coarse roots; about 4 percent gravel; strongly acid; gradual irregular boundary.

Bw2—24 to 46 inches; brownish yellow (10YR 6/6) sand; common medium prominent yellowish red (5YR 5/8) mottles; single grain; loose; few fine roots; about 4 percent gravel; strongly acid; gradual wavy boundary.

C—46 to 60 inches; light yellowish brown (10YR 6/4) sand; common medium and coarse prominent strong brown (7.5YR 5/8) mottles; single grain; loose; about 12 percent gravel; strongly acid.

The solum is 36 to 56 inches thick. The A horizon has chroma of 2 or 3. The Bw horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is dominantly sand, but the range includes loamy sand. The C horizon has value of 5 to 7 and chroma of 4 to 6.

Capac Series

The Capac series consists of somewhat poorly drained, moderately slowly permeable soils on moraines and till plains. These soils formed in loamy deposits. Slope ranges from 0 to 5 percent.

Typical pedon of Capac loam, 0 to 5 percent slopes, 57 feet south and 1,550 feet east of the northwest corner of sec. 29, T. 11 N., R. 12 W., Grant Township:

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; few fine roots;

about 4 percent gravel; neutral; abrupt wavy boundary.

E—10 to 13 inches; brown (10YR 5/3) loam; common fine prominent brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 4 percent gravel; common very dark grayish brown (10YR 3/2) worm channels; neutral; clear wavy boundary.

Bt—13 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; common medium distinct grayish brown (10YR 5/2) and common medium prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; firm; about 8 percent gravel; common very dark grayish brown (10YR 3/2) worm channels in the upper part of the horizon; many distinct grayish brown (10YR 5/2) clay films on horizontal faces of peds; neutral; clear wavy boundary.

C—32 to 60 inches; yellowish brown (10YR 5/4) loam; few fine distinct yellowish brown (10YR 5/8) and common medium distinct gray (10YR 5/1) mottles; massive; firm; 2 to 5 percent gravel; common prominent light gray (10YR 7/1) streaks of lime; strong effervescence; moderately alkaline.

The solum is 26 to 40 inches thick. The E horizon has value of 5 or 6 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly clay loam, but the range includes loam and sandy clay loam. The C horizon has hue of 10YR or 7.5YR and chroma of 2 to 4. It is dominantly loam, but the range includes clay loam.

Carlisle Series

The Carlisle series consists of very poorly drained soils in depressions on outwash plains, till plains, and moraines. These soils formed in woody organic material. Permeability is moderately slow to moderately rapid. Slope ranges from 0 to 2 percent.

Typical pedon of Carlisle muck, 100 feet south and 330 feet west of the northeast corner of sec. 26, T. 13 N., R. 14 W., Dayton Township:

Oa1—0 to 18 inches; muck, black (5YR 2/1) broken face and rubbed; about 20 percent fiber, less than 5 percent rubbed; moderate fine granular structure; friable; many fine and medium and common coarse roots; mainly woody fibers; very strongly acid; gradual wavy boundary.

Oa2—18 to 45 inches; muck, black (5YR 2/1) broken face and rubbed; about 85 percent fiber, less than 10 percent rubbed; moderate thin platy structure; friable; few fine to coarse roots; mainly woody fibers; very strongly acid; clear smooth boundary.

Oa3—45 to 60 inches; muck, very dark brown (10YR 2/2) broken face and rubbed; about 60 percent fiber, less than 10 percent rubbed; massive; friable; mainly woody fibers; very strongly acid.

All of the horizons have hue of 5YR or 10YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 3. They are dominantly mucky material. In some pedons, however, they have thin layers of mucky peat. The organic material is more than 51 inches thick.

Ceresco Series

The Ceresco series consists of somewhat poorly drained, moderately permeable soils on flood plains. These soils formed in loamy alluvial deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Ceresco fine sandy loam, 1,920 feet south and 280 feet west of the northeast corner of sec. 14, T. 11 N., R. 14 W., Bridgeton Township:

A1—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; common fine and medium roots; slight effervescence; slightly alkaline; clear wavy boundary.

A2—11 to 17 inches; dark brown (10YR 3/3) very fine sandy loam; moderate coarse granular structure; friable; common fine and medium roots; slight effervescence; slightly alkaline; abrupt wavy boundary.

Bg—17 to 30 inches; grayish brown (10YR 5/2) very fine sandy loam; common fine prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; occasional dark grayish brown (10YR 4/2) root channels; slight effervescence; slightly alkaline; abrupt wavy boundary.

C—30 to 60 inches; stratified pale brown (10YR 6/3) fine sandy loam and grayish brown (10YR 5/2) very fine sandy loam; few fine prominent yellowish red (5YR 5/6) and common fine prominent red (2.5YR 4/6) mottles; massive; friable; few fine roots; common fine distinct dark grayish brown (10YR 4/2) organic stains; slight effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The A1 horizon has value of 2 or 3 and chroma of 1 or 2. The A2 horizon has value of 2 or 3 and chroma of 1 to 3. It is dominantly fine sandy loam, but the range includes sandy loam. Some pedons do not have an A2 horizon. The Bg horizon has value of 4 or 5 and chroma of 2 to

4. It is very fine sandy loam, sandy loam, fine sandy loam, or loam. The C horizon has value of 4 to 6 and chroma of 1 to 3. It is fine sandy loam, very fine sandy loam, or sandy loam.

Cohoctah Series

The Cohoctah series consists of poorly drained, moderately rapidly permeable soils on flood plains. These soils formed in loamy deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Cohoctah fine sandy loam, 60 feet north and 2,000 feet east of the southwest corner of sec. 35, T. 13 N., R. 13 W., Sherman Township:

A—0 to 11 inches; very dark gray (10YR 3/1) fine sandy loam, dark gray (10YR 4/1) dry; moderate medium granular structure; very friable; many fine to coarse roots; neutral; abrupt wavy boundary.

Cg1—11 to 17 inches; grayish brown (10YR 5/2) sandy loam; common fine distinct yellowish brown (10YR 5/6) and common medium faint gray (10YR 5/1) mottles; weak medium subangular blocky structure; very friable; common coarse and many fine and medium roots; few fine distinct very dark gray (10YR 3/1) organic stains; slightly alkaline; clear wavy boundary.

Cg2—17 to 25 inches; light brownish gray (10YR 6/2) loam; common fine distinct light yellowish brown (10YR 6/4) and common fine faint gray (10YR 5/1) mottles; massive; friable; few coarse and common fine and medium roots; common medium distinct very dark gray (10YR 3/1) organic stains; slightly alkaline; gradual wavy boundary.

Cg3—25 to 30 inches; dark gray (10YR 4/1) loam; few fine distinct yellowish brown (10YR 5/4) mottles; massive; friable; few fine and medium roots; common medium faint very dark gray (10YR 3/1) organic streaks; slightly alkaline; gradual wavy boundary.

Ab—30 to 46 inches; very dark gray (N 3/0) mucky sandy loam; massive; very friable; few fine roots; neutral; diffuse wavy boundary.

C′g—46 to 60 inches; stratified dark gray (10YR 4/1) and very dark gray (N 3/0) mucky sandy loam; massive; very friable; neutral.

The Cg horizon has hue of 5YR or 10YR, value of 3 to 6, and chroma of 1 or 2. It is dominantly loam, fine sandy loam, or sandy loam but in some pedons has strata of sand or fine sand.

The C′g horizon has hue of 10YR or is neutral in hue. It has value of 3 to 5 and chroma of 0 or 1. It is dominantly mucky sandy loam or loam but in some pedons has a few strata of sand.

Coloma Series

The Coloma series consists of excessively drained, rapidly permeable soils on moraines and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 30 percent.

Typical pedon of Coloma sand, 0 to 6 percent slopes, 2,670 feet north and 100 feet east of the southwest corner of sec. 20, T. 16 N., R. 12 W., Home Township:

A—0 to 3 inches; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; weak medium granular structure; very friable; many fine and few medium roots; very strongly acid; abrupt wavy boundary.

E1—3 to 26 inches; brown (7.5YR 4/4) sand; weak medium and coarse subangular blocky structure; friable; few medium and coarse roots; about 1 percent gravel; strongly acid; clear wavy boundary.

E2—26 to 43 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; about 1 percent gravel; strongly acid; clear wavy boundary.

E&Bt—43 to 60 inches; very pale brown (10YR 7/4) sand (E); lamellae of yellowish red (5YR 4/6) loamy sand (Bt) ½ to 1 inch thick thick, less than 4 inches total accumulation of lamellae; single grain; loose; moderately acid.

The content of gravel ranges from 0 to 8 percent in the solum. The A horizon has chroma of 1 to 3. The E&Bt horizon has hue of 10YR, 7.5YR, or 5YR. The E part has value and chroma of 4 to 6. The B part consists of lamellae ⅛ to 1 inch thick.

Cosad Series

The Cosad series consists of somewhat poorly drained soils on lake plains and outwash plains. These soils formed in sandy sediments over loamy and clayey deposits. Permeability is rapid in the upper part of the profile and slow in the lower part. Slope ranges from 0 to 3 percent.

The Cosad soils in this county have a surface layer that is thicker and darker than is definitive for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Cosad loamy sand, 0 to 3 percent slopes, 2,750 feet south and 1,150 feet east of the northwest corner of sec. 2, T. 12 N., R. 14 W., Sheridan Township:

Ap—0 to 12 inches; very dark gray (10YR 3/1) loamy sand, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; very friable; few fine roots; about 2 percent gravel; neutral; abrupt wavy boundary.

Bw—12 to 21 inches; pale brown (10YR 6/3) loamy

sand; many medium prominent strong brown (7.5YR 5/6) mottles in the upper part of the horizon; weak medium subangular blocky structure; very friable; about 8 percent gravel; slightly alkaline; abrupt smooth boundary.

2C—21 to 60 inches; grayish brown (10YR 5/2) silty clay loam; many medium prominent gray (5Y 5/1) and few fine distinct brownish yellow (10YR 6/6) mottles; massive; firm; few fine roots; strong effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The depth to free carbonates is 20 to 40 inches. The A horizon has hue of 5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The Bw horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 2 to 4. The 2C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4.

Covert Series

The Covert series consists of moderately well drained, rapidly permeable soils on moraines and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 4 percent.

Typical pedon of Covert sand, 0 to 4 percent slopes, 1,930 feet north and 2,420 feet east of the southwest corner of sec. 25, T. 11 N., R. 14 W., Bridgeton Township:

Oa—4 inches to 0; black (10YR 2/1), well decomposed forest litter; many fine and medium roots; about 20 percent sand; extremely acid; abrupt wavy boundary.

E—0 to 4 inches; pinkish gray (7.5YR 6/2) sand; single grain; loose; few fine and common medium roots; very strongly acid; abrupt irregular boundary.

Bs—4 to 24 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; common fine and medium roots; about 10 percent dark reddish brown (5YR 3/4) chunks of ortstein; very strongly acid; gradual irregular boundary.

C1—24 to 55 inches; light yellowish brown (10YR 6/4) sand; few fine distinct reddish yellow (7.5YR 6/6) mottles; single grain; loose; strongly acid; gradual wavy boundary.

C2—55 to 60 inches; light yellowish brown (10YR 6/4) sand; many medium and coarse prominent yellowish red (5YR 5/6) mottles; single grain; loose; strongly acid.

The solum is 24 to 45 inches thick. The A horizon has value of 2 to 4 and chroma of 1 to 3. Some pedons do not have an A horizon. The E horizon has hue of 7.5YR or 10YR. The Bs horizon has hue of 10YR, 7.5YR, or 5YR and value and chroma of 4 to 6. The content of ortstein in this horizon ranges from 1 to 10 percent. The C horizon has value of 4 to 7 and chroma of 2 to 6. It has faint to prominent mottles.

Del Rey Series

The Del Rey series consists of somewhat poorly drained, slowly permeable soils on lake plains. These soils formed in loamy and silty lacustrine deposits. Slope ranges from 0 to 4 percent.

Typical pedon of Del Rey loam, 0 to 4 percent slopes, 1,930 feet north and 420 feet west of the southeast corner of sec. 18, T. 12 N., R. 14 W., Sheridan Township:

Ap—0 to 11 inches; dark brown (10YR 3/3) loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

B/E—11 to 15 inches; brown (7.5YR 5/4) loam (B); light brownish gray (10YR 6/2) loam (E) interfingering into the B material; few fine distinct strong brown (7.5YR 5/6) and few fine prominent gray (10YR 6/1) mottles; moderate fine and medium subangular blocky structure; firm; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; moderately acid; clear wavy boundary.

Bt—15 to 19 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and few fine prominent gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; few fine roots; common dark grayish brown (10YR 4/2) root channels; common faint brown (10YR 4/3) clay films on faces of peds; moderately acid; clear wavy boundary.

BC—19 to 24 inches; yellowish brown (10YR 5/4) very fine sandy loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; firm; few fine roots; common dark gray (10YR 4/1) root channels; slight effervescence; slightly alkaline; clear wavy boundary.

C—24 to 60 inches; brown (7.5YR 5/4) silty clay loam; many fine and medium prominent yellowish brown (10YR 5/6) and many fine prominent greenish gray (5GY 6/1) mottles; massive; firm; common white (10YR 8/1) streaks of lime; strong effervescence; moderately alkaline.

The solum is 24 to 32 inches thick. The Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR and chroma of 4 or 5. It is silty clay loam or

silty clay. The C horizon has hue of 7.5YR or 10YR and value of 4 or 5. It is dominantly silty clay loam but in some pedons has strata of silt loam, very fine sandy loam, or loamy very fine sand.

Dixboro Series

The Dixboro series consists of somewhat poorly drained, moderately permeable soils on lake plains. These soils formed in loamy and sandy lacustrine deposits. Slope ranges from 0 to 4 percent.

The Dixboro soils in this county have a surface layer that is lighter in color when dry than is definitive for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Dixboro loamy fine sand, 0 to 4 percent slopes, 2,287 feet north and 30 feet east of the southwest corner of sec. 16, T. 12 N., R. 14 W., Sheridan Township:

Ap—0 to 11 inches; very dark grayish brown (10YR 3/2) loamy fine sand, light brownish gray (10YR 6/2) dry; moderate medium granular structure; very friable; common fine and medium roots; neutral; abrupt smooth boundary.

E—11 to 17 inches; yellowish brown (10YR 5/6) loamy very fine sand; few medium distinct light brownish gray (10YR 6/2) and common medium prominent dark brown (7.5YR 4/4) mottles; weak fine and medium subangular blocky structure; very friable; common fine roots; common very dark grayish brown (10YR 3/2) worm channels; neutral; clear wavy boundary.

Bt—17 to 29 inches; brown (7.5YR 5/4) very fine sandy loam that has strata of fine sand and very fine sand; common medium distinct pinkish gray (7.5YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; common clay bridges between sand grains; neutral; clear wavy boundary.

C1—29 to 55 inches; stratified yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) very fine sandy loam, loamy very fine sand, very fine sand, fine sand, and silty clay loam; common medium distinct light gray (10YR 7/2), common medium prominent strong brown (7.5YR 5/6), and many medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; slightly alkaline; gradual smooth boundary.

C2—55 to 60 inches; pale brown (10YR 6/3) very fine sand; few medium distinct brownish yellow (10YR 6/6) mottles; single grain; loose; strong effervescence; slightly alkaline.

The solum is 24 to 30 inches thick. The depth to free carbonates is 20 to 40 inches. The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. It is very fine sandy loam or sandy loam. The C horizon has value of 5 or 6 and chroma of 2 to 6. It is stratified silty clay loam to fine sand.

Edwards Series

The Edwards series consists of very poorly drained soils in depressions on lake plains and outwash plains. These soils formed in herbaceous organic material 16 to 50 inches deep over marl. Permeability is moderately slow to moderately rapid in the upper part of the profile and varies in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Edwards muck, 246 feet south and 2,600 feet east of the northwest corner of sec. 15, T. 11 N., R. 12 W., Grant Township:

Oa1—0 to 10 inches; muck, black (N 2/0) broken face and rubbed; about 3 percent fiber, 0 percent rubbed; moderate fine granular structure; friable; mainly herbaceous fibers; slightly acid; abrupt smooth boundary.

Oa2—10 to 21 inches; muck, black (10YR 2/1) broken face and rubbed; about 20 percent fiber, 0 percent rubbed; weak medium platy structure; firm; mainly herbaceous fibers; neutral; clear wavy boundary.

Cg1—21 to 39 inches; dark gray (5Y 4/1) marl; massive; firm; violent effervescence; moderately alkaline; clear wavy boundary.

Cg2—39 to 60 inches; olive gray (5Y 5/2) marl; massive; friable; violent effervescence; moderately alkaline.

The O horizon is 16 to 50 inches thick. It has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The Cg horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2.

Glendora Series

The Glendora series consists of poorly drained, rapidly permeable soils that formed in sandy alluvium on flood plains. Slope ranges from 0 to 2 percent.

The Glendora soils in this county have a surface layer that is slightly thinner and more acid than is definitive for the series. These differences, however, do not alter the use and management of the soils.

Typical pedon of Glendora mucky sand, 230 feet south and 1,280 feet west of the northeast corner of sec. 25, T. 12 N., R. 11 W., Croton Township:

A—0 to 5 inches; black (N 2/0) mucky sand, very dark gray (10YR 3/1) dry; moderate medium granular

structure; very friable; many fine and medium and few coarse roots; strongly acid; clear wavy boundary.

Cg—5 to 13 inches; light brownish gray (2.5Y 6/2) loamy very fine sand; many medium prominent very dark grayish brown (10YR 3/2) and common medium prominent strong brown (7.5YR 5/6) mottles; massive; very friable; common fine and medium and few coarse roots; moderately acid; abrupt wavy boundary.

C—13 to 20 inches; brown (10YR 4/3) sand that has streaks of fine sandy loam, which make up 10 to 20 percent of the horizon; common medium prominent strong brown (7.5YR 4/6) and common medium faint very dark grayish brown (10YR 3/2) mottles; single grain; loose; slightly acid; abrupt wavy boundary.

C′g1—20 to 23 inches; dark gray (10YR 4/1) loamy very fine sand; massive; very friable; few fine very dark gray (10YR 3/1) root channels; neutral; clear wavy boundary.

C′g2—23 to 43 inches; gray (10YR 5/1) sand; few fine distinct dark yellowish brown (10YR 4/4) mottles; single grain; loose; neutral; clear wavy boundary.

C′g3—43 to 50 inches; dark gray (N 4/0) very gravelly sand; single grain; loose; about 40 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C′g4—50 to 60 inches; mixed gray (10YR 5/1) and brown (10YR 5/3) sand; single grain; loose; slight effervescence; slightly alkaline.

The A horizon has hue of 10YR or is neutral in hue. It has value of 2 or 3 and chroma of 0 to 2. The C horizon has hue of 10YR or 2.5Y, value of 2 to 6, and chroma of 1 to 4. It is sand, loamy sand, fine sand, loamy very fine sand, very gravelly sand, or fine sandy loam.

Granby Series

The Granby series consists of poorly drained, rapidly permeable soils on outwash plains, on lake plains, and in glacial drainageways. These soils formed in sandy deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Granby mucky sand, 1,880 feet north and 1,840 feet west of the southeast corner of sec. 2, T. 11 N., R. 12 W., Grant Township:

Ap—0 to 10 inches; black (10YR 2/1) mucky sand, very dark gray (10YR 3/1) dry; moderate fine and medium granular structure; very friable; many fine and medium roots; moderately acid; clear smooth boundary.

Bg—10 to 24 inches; grayish brown (10YR 5/2) sand; weak fine subangular blocky structure; very friable; few fine and medium roots; common fine dark brown (10YR 4/3) root channels; moderately acid; gradual smooth boundary.

C1—24 to 48 inches; yellowish brown (10YR 5/4) fine sand; common medium prominent strong brown (7.5YR 5/6) mottles; single grain; loose; few fine roots; common fine dark brown (7.5YR 3/2) root channels; moderately acid; diffuse smooth boundary.

C2—48 to 60 inches; pale brown (10YR 6/3) sand; common medium prominent strong brown (7.5YR 5/6) mottles; single grain; loose; few fine dark brown (7.5YR 3/2) root channels; very strongly acid.

The A horizon has value of 2 or 3. The C horizon has value of 5 or 6 and chroma of 2 to 4. It is sand or fine sand that has occasional bands of coarse sand. The content of gravel is 0 to 5 percent in this horizon. Some pedons have horizons of gravelly sand or gravelly loamy sand below a depth of 40 inches.

Grattan Series

The Grattan series consists of excessively drained, rapidly permeable soils that formed in sandy deposits on outwash plains and moraines. Slope ranges from 0 to 60 percent.

Typical pedon of Grattan sand, 0 to 6 percent slopes, 1,200 feet north and 680 feet west of the southeast corner of sec. 24, T. 11 N., R. 12 W., Grant Township:

A—0 to 4 inches; black (10YR 2/1) sand, very dark gray (10YR 3/1) dry; weak medium granular structure; very friable; common fine and medium roots; very strongly acid; abrupt wavy boundary.

E—4 to 6 inches; brown (7.5YR 5/2) sand; single grain; loose; common fine and medium roots; strongly acid; abrupt broken boundary.

Bs—6 to 20 inches; dark brown (7.5YR 4/4) sand; single grain; loose; common fine and medium roots; few pieces of ortstein; strongly acid; gradual wavy boundary.

C—20 to 60 inches; strong brown (7.5YR 5/6) sand; single grain; loose; few fine roots; strongly acid.

The solum is 20 to 40 inches thick. The content of gravel is 0 to 5 percent. The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The E horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 1 or 2. The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 6. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 4 to 6. The wet substratum phase has mottles and a water table below a depth of 60 inches.

In the banded substratum phases, bands of loamy sand to sandy clay loam are below a depth of 40 inches.

Jebavy Series

The Jebavy series consists of poorly drained soils on lake plains and outwash plains. These soils formed in sandy deposits and have a strongly cemented subsoil. Permeability is moderate in the cemented horizons and rapid in the other horizons. Slope ranges from 0 to 2 percent.

Typical pedon of Jebavy sand, 440 feet north and 1,380 feet east of the southwest corner of sec. 23, T. 11 N., R. 12 W., Grant Township:

A—0 to 6 inches; dark brown (7.5YR 3/2) sand, gray (10YR 5/1) dry; weak fine granular structure; very friable; very strongly acid; clear wavy boundary.

E—6 to 11 inches; pinkish gray (7.5YR 7/2) sand; few fine distinct light brownish gray (10YR 6/2) mottles; weak fine granular structure; very friable; very strongly acid; abrupt smooth boundary.

Bhsm1—11 to 14 inches; black (5YR 2/1) sand; few fine faint dark reddish gray (5YR 4/2) mottles; massive; moderately cemented; strongly acid; abrupt smooth boundary.

Bhsm2—14 to 17 inches; dark reddish brown (5YR 3/3) sand; few medium prominent strong brown (7.5YR 5/6) mottles; massive; strongly cemented; strongly acid; clear smooth boundary.

Bsm1—17 to 21 inches; dark brown (7.5YR 4/4) sand; few fine prominent yellowish brown (10YR 5/8) mottles; massive; strongly cemented; strongly acid; clear smooth boundary.

Bsm2—21 to 29 inches; strong brown (7.5YR 5/6) sand; few fine distinct brownish yellow (10YR 6/6) mottles; massive; weakly cemented; strongly acid; clear smooth boundary.

BC—29 to 42 inches; strong brown (7.5YR 5/6) sand; few fine distinct yellow (10YR 7/6) and light yellowish brown (10YR 6/4) mottles; single grain; loose; few fine strong brown (7.5YR 5/8) iron stains; strongly acid; clear wavy boundary.

C1—42 to 53 inches; yellowish brown (10YR 5/4) sand; few fine faint pale brown (10YR 6/3) mottles; single grain; loose; moderately acid; clear wavy boundary.

C2—53 to 60 inches; pale brown (10YR 6/3) sand; common fine faint yellowish brown (10YR 5/4) mottles; single grain; loose; moderately acid.

The solum is 20 to 50 inches thick. The Bhsm horizon has hue of 7.5YR or 5YR, value of 2 or 3, and chroma of 1 to 3. The Bsm horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. The C horizon has value of 5 or 6 and chroma of 2 to 4.

Kingsville Series

The Kingsville series consists of poorly drained, rapidly permeable soils on lake plains and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 2 percent.

Typical pedon of Kingsville mucky sand, 3,696 feet south and 2,740 feet west of the northeast corner of sec. 24, T. 11 N., R. 14 W., Bridgeton Township:

A—0 to 7 inches; black (10YR 2/1) mucky sand, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; many fine and medium and few coarse roots; moderately acid; abrupt wavy boundary.

Bw—7 to 35 inches; pale brown (10YR 6/3) sand; few fine distinct yellow (10YR 7/6) mottles; single grain; loose; few medium roots; few distinct dark grayish brown (10YR 4/2) root channels; about 1 percent gravel; moderately acid; gradual wavy boundary.

Cg—35 to 60 inches; brown (7.5YR 4/2) sand; single grain; loose; about 3 percent gravel; neutral.

The A horizon has value of 2 or 3. The B horizon has value of 5 or 6 and chroma of 2 or 3. The C horizon has hue of 10YR or 7.5YR and value of 4 to 6.

Lamson Series

The Lamson series consists of poorly drained, moderately permeable soils on lake plains. These soils formed in water-sorted sediments. Slope ranges from 0 to 2 percent.

The Lamson soils in this county are grayer in the upper part of the subsoil than is definitive for the series. This difference, however, does not alter the use and management of the soils.

Typical pedon of Lamson loamy fine sand, 850 feet north and 1,600 feet west of the center of sec. 19, T. 11 N., R. 11 W., Ensley Township:

Ap—0 to 9 inches; black (N 2/0) loamy fine sand, dark gray (10YR 4/1) dry; moderate medium granular structure; very friable; common fine roots; neutral; abrupt smooth boundary.

Cg1—9 to 13 inches; light brownish gray (10YR 6/2) sand that has lenses of fine sandy loam one-quarter to three-quarters of an inch thick; common medium distinct yellowish brown (10YR 5/6) and few medium faint gray (10YR 5/1) mottles; single grain; loose; few fine roots; slightly alkaline; abrupt broken boundary.

2Cg2—13 to 26 inches; grayish brown (2.5Y 5/2) very fine sandy loam that has lenses of sand ½ inch to 2 inches thick; common medium prominent yellowish brown (10YR 5/6), few fine distinct gray (10YR 5/1),

and few fine distinct very dark gray (N 3/0) mottles; massive; firm; few fine roots; slight effervescence; slightly alkaline; clear irregular boundary.

2Cg3—26 to 50 inches; grayish brown (10YR 5/2), stratified fine sand and loamy very fine sand; common medium distinct yellowish brown (10YR 5/6) and few fine faint dark gray (10YR 4/1) mottles; massive; very friable; about 5 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

2Cg4—50 to 60 inches; grayish brown (2.5Y 5/2), stratified loamy very fine sand and fine sand; massive; very friable; about 5 percent gravel; strong effervescence; moderately alkaline.

The A horizon has hue of 7.5YR or 10YR and value of 2 or 3. The C horizon has hue of 2.5Y or 10YR, value of 4 to 6, and chroma of 2 or 3. It is sand, fine sand, very fine sandy loam, fine sandy loam, loamy very fine sand, or loamy fine sand.

Linwood Series

The Linwood series consists of very poorly drained soils in depressions on lake plains, moraines, and till plains. These soils formed in woody organic deposits 16 to 50 inches deep over loamy deposits. Permeability is moderately slow to moderately rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Linwood muck, 2,000 feet north and 800 feet east of the southwest corner of sec. 25, T. 13 N., R. 13 W., Sherman Township:

Oa1—0 to 6 inches; muck, black (N 2/0) broken face, black (5YR 2/1) rubbed; about 10 percent fiber, 5 percent rubbed; moderate medium and coarse granular structure; very friable; woody fibers; strongly acid; clear wavy boundary.

Oa2—6 to 25 inches; muck, black (10YR 2/1) broken face and rubbed; about 20 percent fiber, 10 percent rubbed; weak medium granular structure; very friable; woody fibers; strongly acid; abrupt smooth boundary.

Ab—25 to 29 inches; dark brown (7.5YR 3/2) sandy loam; common medium distinct very dark gray (10YR 3/1) mottles; moderate medium subangular blocky structure; friable; few fine roots; strongly acid; clear wavy boundary.

Cg1—29 to 36 inches; very dark grayish brown (10YR 3/2) loam that has thin strata of sand; common fine distinct black (N 2/0) mottles; moderate thin platy structure; friable; few fine roots; strongly acid; clear wavy boundary.

Cg2—36 to 50 inches; dark grayish brown (2.5Y 4/2) clay loam; few fine distinct very dark gray (5Y 3/1) and gray (5Y 5/1) mottles; moderate thin platy structure; firm; strongly acid; abrupt wavy boundary.

Cg3—50 to 60 inches; gray (5Y 5/1) sandy clay loam that has strata of sand; few fine distinct gray (N 6/0) mottles; massive; firm; strongly acid.

Depth to the Cg horizon typically is 20 to 45 inches but ranges from 16 to 50 inches. This horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5, and chroma of 1 or 2. It is dominantly sandy loam to silty clay loam. In some pedons, however, it has thin bands of sand.

Marlette Series

The Marlette series consists of well drained and moderately well drained, moderately slowly permeable soils on moraines or till plains. These soils formed in loamy deposits. Slope ranges from 0 to 25 percent.

Typical pedon of Marlette loam, moderately wet, 1 to 6 percent slopes, 1,380 feet south and 1,400 feet east of the northwest corner of sec. 8, T. 13 N., R. 14 W., Dayton Township:

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; friable; few fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.

B/E—10 to 18 inches; brown (7.5YR 5/4) loam (B); pale brown (10YR 6/3) loam (E) interfingering into the B material; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; friable; few fine roots; common distinct brown (7.5YR 5/4) clay films on faces of peds; about 2 percent gravel; moderately acid; gradual irregular boundary.

Bt—18 to 29 inches; brown (7.5YR 5/4) clay loam; common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium and coarse subangular blocky structure; firm; few fine roots; common distinct brown (7.5YR 5/4) clay films on faces of peds; about 2 percent gravel; slightly acid; gradual wavy boundary.

C—29 to 60 inches; yellowish brown (10YR 5/4) loam; few medium prominent yellowish red (5YR 4/6) and common fine prominent strong brown (7.5YR 5/6) mottles; massive; firm; about 5 percent gravel; strong effervescence; moderately alkaline.

The solum is 25 to 50 inches thick. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. The E part of the B/E horizon has value of 5 or 6 and chroma of 3 or 4. The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is dominantly clay loam,

but the range includes loam. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam.

Martisco Series

The Martisco series consists of very poorly drained soils in depressions on lake plains and outwash plains. These soils formed in organic material over marl. Permeability is moderate or moderately rapid in the upper organic layers and slow in the marl. Slope is 0 to 1 percent.

Typical pedon of Martisco muck, 130 feet south and 1,380 feet west of the northeast corner of sec. 22, T. 11 N., R. 12 W., Grant Township:

Oa—0 to 11 inches; muck, very dark gray (10YR 3/1) broken face and rubbed; about 2 percent fiber, 0 percent rubbed; weak fine granular structure; friable; few fine roots; common pieces and chunks of marl; violent effervescence; moderately alkaline; abrupt smooth boundary.

C—11 to 60 inches; olive gray (5Y 5/2) marl; massive; firm; violent effervescence; moderately alkaline.

The O horizon is 8 to 15 inches thick. It has hue of 5YR or 10YR, value of 2 or 3, and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y or is neutral in hue. It has value of 5 to 8 and chroma of 0 to 2.

Metea Series

The Metea series consists of well drained soils on moraines and till plains. These soils formed in sandy and loamy deposits. Permeability is rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 1 to 40 percent.

Typical pedon of Metea loamy sand, 1 to 6 percent slopes, 2,610 feet south and 1,480 feet east of the northwest corner of sec. 9, T. 14 N., R. 12 W., Wilcox Township:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 6/2) dry; weak fine granular structure; very friable; common very fine and fine and few medium roots; neutral; clear wavy boundary.

E1—8 to 30 inches; strong brown (7.5YR 5/6) sand; weak medium granular structure; very friable; few very fine and fine roots; slightly acid; abrupt wavy boundary.

E2—30 to 32 inches; pale brown (10YR 6/3) sand; single grain; loose; few very fine and fine roots; slightly acid; abrupt wavy boundary.

2Bt—32 to 48 inches; brown (7.5YR 4/4) clay loam; strong medium subangular blocky structure; firm; few faint dark brown (7.5YR 4/4) clay films on faces of peds; about 5 percent gravel; neutral; clear wavy boundary.

2C—48 to 60 inches; brown (7.5YR 5/2) loam; massive; firm; about 5 percent gravel; violent effervescence; moderately alkaline.

The solum is 30 to 60 inches thick. The content of gravel ranges from 0 to 14 percent. The A horizon has value of 3 or 4 and chroma of 2 to 4. The E horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sand or loamy sand. The 2Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is loam or clay loam.

Napoleon Series

The Napoleon series consists of very poorly drained soils in bogs on outwash plains. These soils formed in herbaceous material. Permeability is moderately slow to moderately rapid. Slope ranges from 0 to 2 percent.

Typical pedon of Napoleon peat, 800 feet north and 1,980 feet east of the southwest corner of sec. 31, T. 12 N., R. 13 W., Garfield Township:

Oi—0 to 5 inches; peat, very dusky red (2.5YR 2/2) broken face and rubbed; about 100 percent fiber, 70 percent rubbed; massive; friable; many fine and medium and few coarse roots; mainly herbaceous fibers; extremely acid; abrupt wavy boundary.

Oe1—5 to 24 inches; mucky peat, very dusky red (2.5YR 2/2) broken face, dark reddish brown (5YR 3/2) rubbed; about 70 percent fiber, 25 percent rubbed; moderate medium and thick platy structure; friable; common fine roots; mainly herbaceous fibers; extremely acid; abrupt wavy boundary.

Oe2—24 to 60 inches; mucky peat, dusky red (2.5YR 3/2) broken face, very dusky red (2.5YR 2/2) rubbed; about 90 percent fiber, 40 percent rubbed; massive; friable; mainly herbaceous fibers; extremely acid.

The organic layers are mainly herbaceous in origin. In some pedons, however, they have as much as 10 percent woody fragments. The surface tier is dominantly peat but is muck in some pedons. The subsurface and bottom tiers have hue of 2.5YR to 10YR, value of 2 to 4, and chroma of 1 to 3.

Parkhill Series

The Parkhill series consists of very poorly drained, moderately slowly permeable soils on till plains and moraines. These soils formed in loamy deposits. Slope ranges from 0 to 2 percent.

The Parkhill soils in this county have a thinner subsoil and redder colors in the substratum than is definitive for the series. These differences, however, do not alter the use and management of the soils.

Typical pedon of Parkhill loam, 50 feet south and 1,800 feet west of the northeast corner of sec. 12, T. 12 N., R. 14 W., Sheridan Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; many fine and few medium roots; about 1 percent gravel; neutral; abrupt smooth boundary.

Bg1—9 to 13 inches; grayish brown (2.5Y 5/2) loam; many medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common fine roots; common medium prominent very dark grayish brown (10YR 3/2) root channels; about 1 percent gravel; neutral; clear smooth boundary.

Bg2—13 to 20 inches; grayish brown (2.5Y 5/2) loam; many fine prominent strong brown (7.5YR 5/6), common fine prominent greenish gray (5GY 5/1), and few fine prominent reddish brown (2.5YR 5/4) mottles; weak fine and medium subangular blocky structure; friable; common fine roots; few medium prominent very dark grayish brown (10YR 3/2) root channels; few fine prominent very dark grayish brown (10YR 3/2) accumulations of manganese; about 1 percent gravel; slightly alkaline; gradual smooth boundary.

BC—20 to 25 inches; brown (7.5YR 5/4) loam; common fine and medium prominent yellowish brown (10YR 5/6) and common fine prominent greenish gray (5GY 5/1) mottles; massive; firm; few fine prominent very dark grayish brown (10YR 3/2) accumulations of manganese; about 2 percent gravel; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—25 to 40 inches; reddish brown (5YR 5/3) loam; common fine and medium prominent yellowish brown (10YR 5/6) and few fine prominent greenish gray (5GY 5/1) mottles; massive; firm; common light gray (N 7/0) streaks of lime; about 2 percent gravel; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—40 to 60 inches; brown (10YR 5/3) clay loam; many medium distinct yellowish brown (10YR 5/6) and common fine and medium prominent greenish gray (5GY 5/1) mottles; massive; very firm; common light gray (N 7/0) streaks of lime; about 2 percent gravel; violent effervescence; moderately alkaline.

The Bg and C horizons are loam or clay loam.

Perrinton Series

The Perrinton series consists of well drained, slowly permeable soils on lake plains. These soils formed in loamy deposits. Slope ranges from 1 to 70 percent.

Typical pedon of Perrinton loam, 1 to 6 percent slopes, 1,200 feet north and 1,260 feet east of the southwest corner of sec. 21, T. 13 N., R. 11 W., Big Prairie Township:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; common fine to coarse roots; moderately acid; abrupt wavy boundary.

E/B—4 to 11 inches; pale brown (10YR 6/3) silt loam (E), very pale brown (10YR 8/3) dry, and reddish brown (5YR 5/4) silt loam (B); E material interfingering and surrounding peds of Bt material; moderate thick platy structure parting to moderate fine angular blocky; firm; common fine to coarse roots; common very dark grayish brown (10YR 3/2) worm channels; moderately acid; clear wavy boundary.

Bt—11 to 26 inches; yellowish red (5YR 4/6) silty clay; moderate fine and medium angular blocky structure; very firm; few fine and medium roots; many distinct reddish brown (5YR 4/4) clay films on faces of peds; few dark grayish brown (10YR 4/2) root channels; slightly acid; clear wavy boundary.

C—26 to 60 inches; stratified light yellowish brown (10YR 6/4) and brown (7.5YR 5/4) silty clay, silty clay loam, and very fine sandy loam; massive; firm; few dark grayish brown (10YR 4/2) root channels; strong effervescence; slightly alkaline.

The solum is 20 to 40 inches thick. The A or Ap horizon has chroma of 2 or 3. The Bt horizon has hue of 5YR or 7.5YR and chroma of 4 to 6. It is silty clay or silty clay loam. The C horizon is stratified silty clay loam, silty clay, silt, silt loam, very fine sandy loam, or fine sand.

Pipestone Series

The Pipestone series consists of somewhat poorly drained, rapidly permeable soils on lake plains and outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 4 percent.

Typical pedon of Pipestone sand, 0 to 4 percent slopes, 60 feet south and 1,320 feet east of the northwest corner of sec. 27, T. 15 N., R. 12 W., Monroe Township:

A—0 to 7 inches; very dark gray (10YR 3/1) sand, dark gray (10YR 4/1) dry; moderate fine granular

structure; very friable; many fine and medium and common coarse roots; strongly acid; abrupt irregular boundary.

E—7 to 13 inches; pale brown (10YR 6/3) sand; common fine distinct brownish yellow (10YR 6/6) mottles; weak fine granular structure; very friable; few fine and very fine roots; moderately acid; clear irregular boundary.

Bs1—13 to 22 inches; reddish brown (5YR 4/4) sand; few fine faint dark reddish brown (5YR 3/4) mottles; weak medium subangular blocky structure; friable; common weak pieces of ortstein; moderately acid; clear wavy boundary.

Bs2—22 to 29 inches; brown (7.5YR 5/4) sand; common medium prominent yellowish red (5YR 5/6) mottles; single grain; loose; common chunks and pieces of ortstein; moderately acid; gradual wavy boundary.

C1—29 to 48 inches; light yellowish brown (10YR 6/4) sand; common medium and coarse prominent yellowish red (5YR 5/8) mottles; single grain; loose; moderately acid; gradual wavy boundary.

C2—48 to 60 inches; light yellowish brown (10YR 6/4) sand; single grain; loose; moderately acid.

The solum is 20 to 50 inches thick. Many pedons have an Oa horizon. The A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has hue of 10YR or 7.5YR and value of 5 or 6. The Bs horizon has hue of 10YR, 7.5YR, or 5YR, value of 4 or 5, and chroma of 3 or 4. It has faint to prominent mottles. In some pedons a Bh horizon is above the Bs horizon. The C horizon has value of 5 or 6 and chroma of 2 to 6.

Plainfield Series

The Plainfield series consists of excessively drained soils on outwash plains and moraines. These soils formed in sandy deposits. Permeability is rapid. Slope ranges from 0 to 70 percent.

Typical pedon of Plainfield sand, 0 to 6 percent slopes, 400 feet south and 2,650 feet east of the northwest corner of sec. 28, T. 11 N., R. 14 W., Bridgeton Township:

A—0 to 2 inches; black (10YR 2/1) sand, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; many fine and medium and few coarse roots; very strongly acid; abrupt wavy boundary.

Bw1—2 to 7 inches; dark brown (7.5YR 4/4) sand; weak medium subangular blocky structure; very friable; many fine and medium and few coarse roots; very strongly acid; clear wavy boundary.

Bw2—7 to 27 inches; strong brown (7.5YR 5/6) sand; single grain; loose; common fine and medium and few coarse roots; strongly acid; gradual wavy boundary.

C—27 to 60 inches; very pale brown (10YR 7/4) sand; single grain; loose; strongly acid.

The solum is 20 to 48 inches thick. The content of gravel ranges from 0 to 10 percent. The A horizon has value of 2 or 3 and chroma of 1 to 3. The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. The C horizon has value of 5 to 7 and chroma of 4 to 6. The wet substratum phase has mottles and a water table below a depth of 72 inches. The banded substratum phase has bands of loamy sand to sandy clay loam below a depth of 40 inches.

Scalley Series

The Scalley series consists of well drained soils on moraines. These soils formed in loamy deposits over sandy deposits. Permeability is moderately slow in the upper part of the profile and rapid in the lower part. Slope ranges from 1 to 18 percent.

Typical pedon of Scalley loam, 1 to 6 percent slopes, 900 feet south and 2,590 feet west of the northeast corner of sec. 33, T. 11 N., R. 13 W., Ashland Township:

Ap—0 to 7 inches; dark brown (10YR 3/3) loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure parting to moderate medium granular; friable; few fine roots; about 1 percent gravel; neutral; abrupt smooth boundary.

B/E—7 to 14 inches; dark brown (7.5YR 4/4) clay loam (B); strong medium subangular blocky structure; firm; few fine roots; about 1 percent gravel; brown (10YR 5/3) loam (E) interfingering into the B material; common faint brown (7.5YR 5/4) clay films on faces of peds; about 1 percent gravel; neutral; clear wavy boundary.

Bt—14 to 36 inches; dark brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; common fine roots; about 2 percent gravel; common distinct brown (10YR 4/3) clay films on faces of peds; slightly acid; abrupt wavy boundary.

2C—36 to 60 inches; stratified brown (7.5YR 5/4) and reddish yellow (7.5YR 6/6) fine sand; single grain; loose; slightly acid.

The solum is 22 to 40 inches thick. The content of gravel ranges from 1 to 10 percent in the solum. The A horizon has chroma of 2 or 3. The E horizon has chroma of 3 or 4. It is fine sandy loam or loam. Some pedons do not have an E horizon. The Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 4

to 6. The 2C horizon has value of 5 or 6 and chroma of 4 to 6. It is dominantly sand, loamy sand, or fine sand. In some pedons, however, it has strata of sandy loam.

Selfridge Series

The Selfridge series consists of somewhat poorly drained soils on till plains and moraines. These soils formed in sandy and loamy deposits. Permeability is rapid in the upper part of the profile and moderately slow in the lower part. Slope ranges from 0 to 4 percent.

Typical pedon of Selfridge loamy sand, 0 to 4 percent slopes, 100 feet south and 514 feet west of the northeast corner of sec. 17, T. 13 N., R. 14 W., Dayton Township:

Ap—0 to 12 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; few fine roots; slightly acid; abrupt smooth boundary.

Bw—12 to 23 inches; yellowish brown (10YR 5/4) loamy sand; common medium distinct strong brown (7.5YR 5/6), common coarse distinct light brownish gray (10YR 6/2), and few medium distinct yellowish brown (10YR 5/6) mottles; weak medium granular structure; very friable; few fine roots; few faint dark grayish brown (10YR 4/2) root channels; slightly acid; clear wavy boundary.

2Bt—23 to 37 inches; brown (7.5YR 5/4) loam; common medium distinct strong brown (7.5YR 5/8) and common medium prominent light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; firm; common distinct pinkish gray (7.5YR 6/2) clay films on vertical faces of peds; neutral; clear wavy boundary.

2C1—37 to 47 inches; brown (7.5YR 5/4) clay loam; common medium distinct strong brown (7.5YR 5/8) and common fine prominent gray (5Y 6/1) mottles; massive; firm; few fine white (10YR 8/1) accumulations of lime; about 2 percent gravel; strong effervescence; slightly alkaline; gradual wavy boundary.

2C2—47 to 60 inches; brown (7.5YR 5/4) clay loam; common medium prominent yellowish brown (10YR 5/6), common fine prominent gray (5Y 6/1), and few coarse prominent yellowish brown (10YR 5/8) mottles; massive; firm; coarse white (10YR 8/1) accumulations of lime; about 3 percent gravel; violent effervescence; slightly alkaline.

The thickness of the solum and the depth to free carbonates range from 24 to 40 inches. The content of gravel is 0 to 5 percent in the solum. The Ap horizon has value of 2 or 3. The Bw horizon has value and chroma of 4 to 6. It is loamy sand or sand. The 2Bt horizon has value of 4 or 5. It is loam, sandy clay loam, clay loam, or silty clay loam.

Sickles Series

The Sickles series consists of poorly drained soils on lake plains. These soils formed in sandy sediments over clayey deposits. Permeability is rapid in the upper part of the profile and very slow in the lower part. Slope ranges from 0 to 2 percent.

Typical pedon of Sickles loamy fine sand, 2,065 feet south and 204 feet west of the northeast corner of sec. 17, T. 12 N., R. 14 W., Sheridan Township:

Ap—0 to 8 inches; black (10YR 2/1) loamy fine sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.

Cg1—8 to 20 inches; grayish brown (10YR 5/2) loamy fine sand; weak medium granular structure; very friable; few fine roots; common medium gray (10YR 5/1) root channels; neutral; gradual smooth boundary.

Cg2—20 to 27 inches; light brownish gray (2.5Y 6/2) loamy fine sand that has thin strata of silt loam; few medium prominent brownish yellow (10YR 6/6) and common medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; few medium black (N 2/0) root channels; slightly alkaline; clear smooth boundary.

2Cg3—27 to 60 inches; brown (7.5YR 5/2) silty clay; many medium prominent yellowish brown (10YR 5/6), common medium prominent gray (5Y 6/1), and few fine prominent white (2.5Y 8/0) mottles; massive; firm; slightly alkaline; strong effervescence.

Depth to the 2C horizon and to free carbonates ranges from 20 to 40 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Cg horizon has value of 3 to 6 and chroma of 1 or 2. It is dominantly loamy fine sand, fine sand, or sand. In some pedons, however, it has thin strata of silt loam. The 2Cg horizon has hue of 7.5YR, 10YR, or 2.5Y or is neutral in hue. It has value of 5 to 7 and chroma of 0 to 2. It is silty clay loam or silty clay.

Sparta Series

The Sparta series consists of excessively drained, rapidly permeable soils on outwash plains. These soils formed in sandy deposits. Slope ranges from 0 to 12 percent.

The Sparta soils in this county are more acid and have lower base saturation in the A horizon than is definitive for the series. These differences, however, do not affect the use and management of the soils.

Typical pedon of Sparta sand, 0 to 6 percent slopes, 200 feet south and 1,320 feet west of the northeast corner of sec. 35, T. 12 N., R. 12 W., Brooks Township:

A—0 to 12 inches; black (10YR 2/1) sand, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; many fine roots; extremely acid; clear smooth boundary.

Bw1—12 to 20 inches; dark yellowish brown (10YR 4/6) sand; weak fine subangular blocky structure; loose; common fine roots; about 1 percent gravel; very strongly acid; diffuse smooth boundary.

Bw2—20 to 32 inches; yellowish brown (10YR 5/6) sand; single grain; loose; few fine roots; about 1 percent gravel; very strongly acid; clear smooth boundary.

C—32 to 60 inches; very pale brown (10YR 7/4) sand; single grain; loose; very strongly acid.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw and C horizons are sand or fine sand. The Bw horizon has value of 3 to 5. The C horizon has value of 6 or 7 and chroma of 4 to 6.

Spinks Series

The Spinks series consists of well drained, moderately rapidly permeable soils on moraines. These oils formed in sandy deposits. Slope ranges from 0 to 40 percent.

Typical pedon of Spinks loamy sand, 0 to 6 percent slopes, 67 feet north and 322 feet west of the southeast corner of sec. 21, T. 15 N., R. 11 W., Norwich Township:

Ap—0 to 11 inches; dark brown (10YR 3/3) loamy sand, pale brown (10YR 6/3) dry; single grain; loose; few medium and coarse roots; neutral; abrupt smooth boundary.

E1—11 to 22 inches; yellowish brown (10YR 5/6) sand; single grain; loose; few fine roots; about 3 percent gravel; neutral; gradual wavy boundary.

E2—22 to 27 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few fine roots; about 3 percent gravel; neutral; gradual wavy boundary.

E&Bt—27 to 44 inches; brownish yellow (10YR 6/6) sand (E); single grain; loose; lamellae of brown (7.5YR 4/4) loamy sand (Bt) one-eighth to one-quarter inch thick; very weak medium granular structure; very friable; common clay bridges between sand grains; few fine roots; about 1 percent gravel; slightly acid; gradual wavy boundary.

Bt&E—44 to 60 inches; lamellae of strong brown (7.5YR 5/6) loamy sand (Bt) ½ to 1 inch thick; very weak medium granular structure; very friable; common clay bridges between sand grains; yellowish brown (10YR 5/6) sand (E); single grain; loose; slightly acid.

The solum is 36 to more than 60 inches thick. The content of gravel is 0 to 5 percent throughout the profile. The E horizon has value of 4 to 6 and chroma of 3 to 6. It is sand, fine sand, or loamy sand. The Bt part of the E&Bt and Bt&E horizons consists of lamellae ⅛ inch to 5 inches thick. Depth to the uppermost lamellae ranges from 15 to 36 inches. The lamellae have hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. They are loamy sand, sandy loam, or loamy fine sand.

Thetford Series

The Thetford series consists of somewhat poorly drained, moderately rapidly permeable soils on lake plains, outwash plains, and moraines. These soils formed in sandy deposits. Slope ranges from 0 to 4 percent.

Typical pedon of Thetford loamy fine sand, 0 to 4 percent slopes, 10 feet north and 660 feet west of the southeast corner of sec. 2, T. 15 N., R. 12 W., Monroe Township:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak coarse granular structure; very friable; many fine and very fine and common medium roots; moderately acid; abrupt smooth boundary.

Bw—9 to 17 inches; dark yellowish brown (10YR 4/4) loamy fine sand; common fine distinct dark brown (7.5YR 4/4) and few fine distinct dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; very friable; many fine, common very fine, and few medium roots; few fine distinct black (N 2/0) accumulations of manganese; moderately acid; clear wavy boundary.

E—17 to 26 inches; yellowish brown (10YR 5/4) loamy fine sand; common fine distinct brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; very friable; common fine roots; common fine distinct black (N 2/0) accumulations of manganese; few firm concretions of iron one-quarter to one-half inch thick; moderately acid; clear wavy boundary.

E&Bt1—26 to 33 inches; light yellowish brown (10YR 6/4) loamy fine sand (E); lamellae of brown (7.5YR 4/4) fine sandy loam (Bt) one-eighth to one-quarter inch thick; weak medium subangular blocky

structure; very friable; common fine roots; about 3 percent gravel; strongly acid; clear wavy boundary.

E&Bt2—33 to 50 inches; yellowish brown (10YR 5/4) loamy fine sand (E); lamellae of brown (7.5YR 5/4) loamy fine sand (Bt) ½ to 1 inch thick; weak coarse subangular blocky structure; very friable; common fine roots; about 3 percent gravel; moderately acid; clear wavy boundary.

C—50 to 60 inches; yellowish brown (10YR 5/4) fine sand that has streaks of loamy fine sand; single grain; loose; strongly acid.

The A horizon has value of 3 or 4 and chroma of 1 or 2. The Bw horizon has value of 3 to 5 and chroma of 3 or 4. It is sand, loamy sand, or loamy fine sand. The E horizon has value of 5 or 6 and chroma of 2 to 6. It is sand, loamy sand, or loamy fine sand. The Bt part of the E&Bt horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. It is loamy sand, sandy loam, or fine sandy loam.

Toogood Series

The Toogood series consists of somewhat excessively drained and moderately well drained soils on outwash plains, moraines, and terraces. These soils formed in deposits of sand and gravel. Permeability is rapid in the upper part of the profile and very rapid in the lower part. Slope ranges from 0 to 25 percent.

Typical pedon of Toogood loamy sand, 0 to 6 percent slopes, 1,950 feet north and 500 feet east of the southwest corner of sec. 27, T. 13 N., R. 11 W., Big Prairie Township:

A—0 to 4 inches; black (10YR 2/1) loamy sand, dark gray (10YR 4/1) dry; weak medium granular structure; very friable; many fine roots; about 1 percent gravel; strongly acid; abrupt wavy boundary.

Bw1—4 to 8 inches; dark brown (10YR 4/3) loamy sand; weak fine and medium subangular blocky structure; very friable; common fine and medium roots; about 1 percent gravel; strongly acid; clear irregular boundary.

Bw2—8 to 34 inches; yellowish brown (10YR 5/6) loamy sand; weak medium subangular blocky structure; very friable; common medium and coarse and few fine roots; about 10 percent gravel and cobbles; strongly acid; clear wavy boundary.

2Bt—34 to 36 inches; dark brown (7.5YR 4/4) gravelly sandy loam; weak medium subangular blocky structure; very friable; common faint clay bridges between sand grains; about 30 percent gravel; slightly acid; clear irregular boundary.

3C—36 to 60 inches; light yellowish brown (10YR 6/4) very gravelly coarse sand; single grain; loose; about 50 percent gravel; strong effervescence; moderately alkaline.

The solum is 30 to 45 inches thick. The content of gravel ranges from 1 to 30 percent in the solum and from 15 to 55 percent in the substratum. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. It is sand, loamy sand, gravelly sand, or gravelly loamy sand. The 2Bt horizon is less than 3 inches thick. It has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 4 to 6. The 3C horizon has value of 5 or 6 and chroma of 3 or 4. It is gravelly coarse sand, gravelly sand, gravelly loamy sand, very gravelly coarse sand, or very gravelly loamy sand. In some pedons the 2Bt or 3C horizon has high-chroma mottles below a depth of 30 inches.

Tustin Series

The Tustin series consists of well drained soils on lake plains. These soils formed in sandy deposits over clayey deposits. Permeability is rapid in the upper part of the profile and slow in the lower part. Slope ranges from 1 to 18 percent.

Typical pedon of Tustin loamy sand, 1 to 6 percent slopes, 2,580 feet north and 2,030 feet east of the southwest corner of sec. 2, T. 12 N., R. 14 W., Sheridan Township:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loamy sand, gray (10YR 5/1) dry; weak fine and medium granular structure; very friable; common fine and few medium roots; moderately acid; abrupt wavy boundary.

E1—6 to 7 inches; light brown (7.5YR 6/4) loamy sand; weak fine and medium granular structure; very friable; common fine and few medium roots; moderately acid; abrupt broken boundary.

E2—7 to 21 inches; strong brown (7.5YR 5/6) loamy sand; weak fine and medium subangular blocky structure; very friable; common fine and few medium roots; about 4 percent gravel; moderately acid; clear smooth boundary.

2Bt—21 to 36 inches; brown (7.5YR 5/4) silty clay loam; moderate medium subangular blocky structure parting to moderate very fine subangular blocky; firm; common fine roots; common very dark brown (10YR 2/2) root channels; few faint distinct clay films on faces of peds; neutral; gradual smooth boundary.

2C—36 to 60 inches; brown (7.5YR 5/4) silty clay loam; common fine prominent greenish gray (5GY 6/1) and common fine and medium distinct strong brown

(7.5YR 5/6) mottles; moderately alkaline; slight effervescence.

The solum is 30 to 55 inches thick. The A horizon has value of 2 to 4 and chroma of 2 or 3. The E horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 4 to 6. It is loamy sand or sand. The 2Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 4 to 6. The 2C horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 to 6, and chroma of 2 to 4. It is silty clay loam, silty clay, clay, or clay loam.

Watseka Series

The Watseka series consists of somewhat poorly drained, rapidly permeable soils on outwash plains. These soils formed in sandy and gravelly glacial drift. Slope ranges from 0 to 4 percent.

Typical pedon of Watseka loamy sand, 0 to 4 percent slopes, 40 feet north and 2,040 feet east of the southwest corner of sec. 30, T. 12 N., R. 13 W., Garfield Township:

Ap—0 to 14 inches; very dark grayish brown (10YR 3/2) loamy sand, grayish brown (10YR 5/2) dry; weak fine and medium granular structure; very friable; common fine and few medium roots; neutral; abrupt smooth boundary.

Bw—14 to 24 inches; strong brown (7.5YR 5/6) sand; common medium prominent yellowish red (5YR 5/8) mottles; weak fine and medium subangular blocky structure; very friable; few fine roots; about 2 percent gravel; common medium distinct very dark grayish brown (10YR 3/2) root channels; few fine distinct very dark brown (10YR 2/2) worm channels; neutral; clear wavy boundary.

BC—24 to 41 inches; very pale brown (10YR 7/3) sand; few medium prominent brownish yellow (10YR 6/8) mottles; single grain; loose; about 4 percent gravel; slightly acid; clear wavy boundary.

2C1—41 to 50 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; about 15 percent gravel; slightly acid; clear smooth boundary.

2C2—50 to 60 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; about 15 percent gravel; slight effervescence; slightly alkaline.

The solum is 24 to 41 inches thick. The A horizon has value of 2 or 3 and chroma of 1 to 3. The Bw horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 6. It is sand or loamy sand. The 2C horizon has value of 4 to 7 and chroma of 1 to 4. It is slightly acid to moderately alkaline. It is gravelly coarse sand, sand, or gravelly sand.

Wauseon Series

The Wauseon series consists of very poorly drained, slowly permeable soils on lake plains. These soils formed in clayey and loamy deposits. Slope ranges from 0 to 2 percent.

The Wauseon soils in this county are slightly finer textured in the upper part of the subsoil than is definitive for the series. This difference, however, does not affect the use and management of the soils.

Typical pedon of Wauseon loam, 359 feet north and 429 feet east of the southwest corner of sec. 18, T. 12 N., R. 14 W., Sheridan Township:

Ap—0 to 17 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; moderate fine and medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bg1—17 to 28 inches; gray (5Y 5/1) loam; common medium prominent light olive brown (2.5Y 5/6) mottles; moderate medium subangular blocky structure; friable; few fine and medium roots; common very dark gray (N 3/0) root channels; slightly acid; clear smooth boundary.

Bg2—28 to 32 inches; gray (5Y 5/1) silty clay loam that has strata of silt loam; few medium distinct bluish gray (5B 6/1), few medium prominent olive yellow (2.5Y 6/6), and many medium prominent dark brown (7.5YR 4/4) mottles; moderate fine and medium subangular blocky structure; friable; few fine and medium roots; neutral; diffuse smooth boundary.

C—32 to 50 inches; olive brown (2.5Y 4/4) silty clay; common medium distinct gray (N 6/0) and common medium prominent dark brown (7.5YR 4/4) mottles; massive; firm; strong effervescence; slightly alkaline; diffuse smooth boundary.

Cg—50 to 60 inches; olive gray (5Y 5/2) silty clay; common medium distinct olive (5Y 4/4) and common medium prominent light olive brown (2.5Y 5/4) mottles; massive; very firm; strong effervescence; slightly alkaline.

The solum is 25 to 60 inches thick. The Ap horizon has value of 2 or 3. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6, and chroma of 1 to 4. In some pedons it has strata of fine sand or very fine sandy loam.

Formation of the Soils

The paragraphs that follow relate the factors of soil formation to the soils in Newaygo County and explain the processes of soil formation.

Factors of Soil Formation

Soil forms through the interaction of five major factors—the physical, chemical, and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the processes of soil formation have acted on the parent material *(8)*.

Climate and plant and animal life are the active forces of soil formation. They slowly change the parent material into a natural body of soil that has genetically related layers, called horizons. The effects of climate and of plant and animal life are conditioned by relief. The nature of the parent material affects the kind of soil profile that forms. In extreme cases, it determines the soil profile entirely. Finally, time is needed for the transformation of the parent material into a soil. Some time is always needed for the differentiation of soil horizons.

The factors of soil formation are so closely interrelated in their effects on the soils that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Parent Material

Parent material, the unconsolidated mass in which a soil forms, determines the limits of the chemical and mineralogical composition of the soil. Glaciers or glacial meltwater deposited the parent material of the soils in Newaygo County. Glaciers covered the county 10,000 to 12,000 years ago. The subsequent action of water and wind has reworked and redeposited some of the parent material. Although the parent materials are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited. The dominant kinds of parent material in the county are glacial till, outwash deposits, lacustrine deposits, alluvium, and organic material.

Glacial till was deposited directly by glaciers with a minimum of water action. It is a mixture of particles of different sizes. The small pebbles in glacial till have sharp corners, indicating that they have not been worn by water. The glacial till in Newaygo County is calcareous loam, calcareous clay loam, or sand. Marlette soils are an example of soils that formed in glacial till. They typically are moderately fine textured and have a well developed subsoil.

Outwash material was deposited by running water from melting glaciers. The size of the particles varies, depending on the speed of the stream that carried the material. As the speed of the stream decreased, the coarser particles were deposited. Only the finer particles, such as very fine sand, silt, and clay, can be carried by slowly moving water. Outwash deposits generally occur as layers of particles of similar size, such as fine sand, sand, coarse sand, gravel, and other coarse particles. Boyer soils are an example of soils that formed in deposits of outwash.

Lacustrine material was deposited from still, or ponded, glacial meltwater. Because the coarser fragments dropped out of the moving water as outwash, only the finer particles, such as very fine sand, silt, and clay, remained to settle out in the still water. The soils in Newaygo County that formed in lacustrine deposits typically are medium textured, moderately fine textured, and fine textured. Del Rey soils are an example.

Alluvium is material that was recently deposited by floodwater from streams. This material varies in texture, depending on the speed of the water from which it was deposited. Glendora and Cohoctah soils are examples of soils that formed in alluvium.

Organic material occurs as deposits of plant remains. After the glaciers receded, water was left standing in depressions on the outwash plains, flood plains, moraines, and till plains. Because of the wetness, the grasses, sedges, and water-tolerant plants that grew around the edges of these depressions did not decompose quickly after they died. Eventually, the plant residue filled the depressions and decomposed to form

muck. Carlisle soils are an example of soils that formed in organic material.

Plant and Animal Life

Green plants are the principal organisms that have influenced soil formation in Newaygo County. Bacteria, fungi, earthworms, and human activities also have been important. The chief contribution of plant and animal life is the addition of organic material and nitrogen to the soil. The kind of organic material in the soil depends on the kinds of plants that grew on the soil in the past. The remains of these plants accumulated on the surface, decayed, and eventually became organic matter. The roots of the plants provided channels for the downward movement of water through the soil and added organic matter as they decayed. Bacteria in the soil helped to break down the organic matter into plant nutrients.

The native vegetation in Newaygo County was mainly deciduous and coniferous trees. Coniferous trees grew mainly on the sandy soils. Differences in natural soil drainage and minor variations in the parent material affected the composition of the forest species. The well drained soils on uplands, such as Marlette and Metea soils, were covered mainly by sugar maple, oak, and beech. The poorly drained and very poorly drained soils were covered by soft maple, elm, and ash. Examples are Parkhill and Wauseon soils, which contain a considerable amount of organic matter. The well drained, sandy soils on uplands, such as Plainfield and Coloma soils, were covered mainly by pine.

Climate

Climate determines the kind of plant and animal life on and in the soil. It also determines the amount of water available for the weathering of minerals and for the translocation of soil material. Through its influence on soil temperature, climate also determines the rate of chemical reaction in the soil.

The climate in Newaygo County, which is presumably similar to that under which the soils formed, is cool and humid. It generally is uniform throughout the county, but its effect is modified locally, depending on the proximity to large lakes. Differences in climate account for only minor differences among the soils in the county.

Relief

Relief affects the natural drainage of soils, the rate of erosion, the kind of plant cover, and the soil temperature. Slopes range from 0 to 70 percent in Newaygo County. Runoff is most rapid on the steeper slopes. In low areas water is temporarily ponded.

The soils in the county range from excessively drained on sandy ridgetops to very poorly drained in depressions. Through its effect on soil aeration, drainage partly determines the color of the soil. In Marlette and other well aerated soils, the iron and aluminum compounds are brightly colored and oxidized. Parkhill and other poorly aerated soils are dull gray and mottled. The Marlette and Parkhill soils formed in similar kinds of parent material.

Time

Generally, a long time is needed for the development of distinct soil horizons. Differences in the length of time that parent material has been in place are commonly reflected in the degree of profile development. Some soils form rapidly. Others form slowly.

The soils in Newaygo County range from young to mature. The glacial deposits in which many of the soils formed have been exposed to the soil-forming factors long enough for the development of distinct horizons. The soils that formed in recent alluvial sediments, however, have not been in place long enough for the development of distinct horizons. Cohoctah soils are an example of young alluvial soils. Marlette soils are an example of mature soils. Their horizons are distinct, and lime has been leached from their solum.

Processes of Soil Formation

The processes responsible for the development of soil horizons in the unconsolidated parent material are referred to as soil genesis. The physical, chemical, and biological properties of the horizons are referred to as soil morphology.

Several processes were involved in the development of horizons in the soils of Newaygo County. These are the accumulation of organic matter, the leaching of lime (calcium carbonate) and other bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most of the soils, more than one of these processes has been active in the development of horizons.

As organic matter accumulates at the surface of a soil, an A horizon forms. If the soil is plowed, this horizon is mixed into the plow layer, or Ap horizon. In the soils of Newaygo County, the surface layer ranges from high to low in content of organic matter. Parkhill soils are an example of soils that have a high content of organic matter in the surface layer. Spinks soils are an example of soils that have a low content of organic matter.

The leaching of carbonates and other bases has occurred in most of the soils. The leaching of bases generally precedes the translocation of silicate clay minerals. Many of the soils in the county are moderately leached or strongly leached. For example, Spinks soils are leached of carbonates to a depth of more than 60

inches. Marlette soils are leached to a depth of about 40 inches. The difference in the depth of leaching is a result of time, relief, and parent material.

Gleying, or the reduction and transfer of iron, is evident in somewhat poorly drained, poorly drained, and very poorly drained soils. The gray subsoil of these soils indicates the reduction and loss of iron. Parkhill soils are an example of strongly gleyed soils.

Horizon development is partly the result of the translocation of clay minerals. An eluviated, or leached, E horizon has less clay and typically is lighter colored than the illuviated B horizon below it. The B horizon typically has an accumulation of clay, or clay films, in pores and on the faces of peds. The soils at this stage of formation probably were leached of carbonates and soluble salts to a considerable extent before the silicate clays were translocated. Marlette soils are an example.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a

particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops

unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material. See Peat.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other

elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs onlyafter rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material. See Mucky peat.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a

constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. The methods of irrigation generally used in this survey area are:
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Muck. The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Mucky peat. Organic soil material intermediate in degree of decomposition between the less decomposed fibric material (peat) and the more decomposed sapric material (muck).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	below 3.5
Extremely acid	3.5 to 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material. See Muck.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. Classes of simple slopes in this survey area are as follows:

Nearly level	0 to 2 percent
Very gently sloping	2 to 4 percent
Gently sloping	4 to 6 percent
Moderately sloping	6 to 12 percent
Strongly sloping	12 to 18 percent
Moderately steep and steep	18 to 40 percent
Very steep	more than 40 percent

Classes of complex slopes are as follows:

Nearly level	0 to 2 percent
Gently undulating	2 to 4 percent
Undulating	4 to 6 percent
Gently rolling	6 to 12 percent
Rolling	12 to 18 percent
Hilly and steep	18 to 40 percent
Very steep	more than 40 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth

from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-80 at Hesperia, in Oceana County; Baldwin, in Lake County; and Big Rapids, in Mecosta County)

Month	Temperature						Precipitation				
				2 years in 10 will have--		Average		2 years in 10 will have--		Average	
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	number of growing degree days*	Average	Less than--	More than--	number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
HESPERIA:											
January----	28.6	12.7	20.6	50	-18	0	2.40	1.47	3.22	7	24.3
February---	31.6	12.5	22.0	50	-16	0	1.63	.91	2.26	5	14.3
March------	41.2	21.3	31.2	69	-8	5	2.30	1.27	3.20	6	9.8
April------	56.4	32.9	44.6	81	13	61	3.34	1.95	4.57	7	2.2
May--------	69.0	42.5	55.7	88	23	228	2.70	1.52	3.75	6	.0
June-------	78.2	51.8	65.0	93	32	459	3.05	1.58	4.33	6	.0
July-------	82.1	56.1	69.1	94	39	600	2.81	1.60	3.87	6	.0
August-----	80.1	54.7	67.4	93	36	547	3.79	1.57	5.66	6	.0
September--	72.2	47.6	59.9	90	28	314	3.22	1.43	4.80	6	.0
October----	60.7	38.3	49.5	82	18	111	3.05	1.31	4.53	7	.2
November---	45.7	29.0	37.3	70	6	11	2.78	1.80	3.66	8	6.7
December---	33.4	18.6	26.0	56	-8	**	2.50	1.38	3.49	7	18.0
Yearly:											
Average---	56.6	34.8	45.7	---	---	---	---	---	---	---	---
Extreme---	---	---	---	95	-20	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,336	33.57	28.30	38.56	77	75.5
BALDWIN:											
January----	29.0	11.1	20.1	51	-24	0	2.29	1.49	3.00	7	25.0
February---	32.1	9.4	20.7	51	-22	0	1.68	1.00	2.28	5	16.3
March------	41.9	18.7	30.3	70	-15	4	2.18	1.30	2.97	6	10.9
April------	57.3	31.3	44.3	82	10	60	3.19	2.15	4.14	8	1.9
May--------	70.5	42.0	56.3	89	21	247	2.93	1.72	4.02	7	.1
June-------	79.3	51.0	65.2	95	30	463	3.27	1.45	4.83	7	.0
July-------	83.1	54.7	68.9	95	37	593	2.88	1.71	3.92	6	.0
August-----	80.9	53.2	67.0	94	35	536	3.62	1.67	5.30	6	.0
September--	72.3	46.1	59.2	91	26	297	3.29	1.51	4.82	7	.0
October----	61.0	36.6	48.8	82	17	102	3.00	1.48	4.32	7	.5
November---	45.8	27.4	36.6	69	2	11	3.20	1.78	4.46	8	10.0
December---	33.5	17.0	25.2	56	-12	**	2.44	1.52	3.27	8	18.0
Yearly:											
Average---	57.2	33.2	45.2	---	---	---	---	---	---	---	---
Extreme---	---	---	---	97	-26	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,313	33.97	30.35	37.51	82	82.7

See footnotes at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days*	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
BIG RAPIDS:											
January----	28.0	11.3	19.6	50	-20	0	1.94	1.18	2.62	6	20.9
February---	31.0	11.3	21.1	50	-17	0	1.50	.69	2.19	5	13.6
March------	40.3	20.7	30.5	69	-7	4	2.12	1.25	2.90	6	10.8
April------	55.6	32.6	44.1	82	12	52	3.13	1.97	4.17	7	2.0
May--------	68.3	42.6	55.4	88	25	219	2.88	1.66	3.96	7	.0
June-------	77.6	51.9	64.7	94	34	446	3.22	1.64	4.57	6	.0
July-------	81.7	56.0	68.8	94	41	588	2.58	1.49	3.56	6	.0
August-----	79.4	54.5	66.9	94	38	527	3.41	1.55	5.01	6	.0
September--	70.9	46.8	58.8	90	28	282	3.30	1.39	4.93	7	.0
October----	59.4	37.2	48.3	82	19	86	2.83	1.42	4.04	7	.6
November---	44.5	28.4	36.5	69	5	9	2.77	1.76	3.68	7	6.3
December---	32.6	17.5	25.0	57	-9	**	2.22	1.37	2.99	6	16.3
Yearly:											
Average---	55.8	34.2	45.0	---	---	---	---	---	---	---	---
Extreme---	---	---	---	96	-21	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,213	31.90	28.08	35.56	76	70.5

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

** Less than 0.5.

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-80 at Hesperia, in Oceana County; Baldwin, in Lake County; and Big Rapids, in Mecosta County)

Probability	Temperature: 24 °F or lower	Temperature: 28 °F or lower	Temperature: 32 °F or lower
HESPERIA:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 8	May 22	June 12
2 years in 10 later than--	May 3	May 18	June 6
5 years in 10 later than--	Apr. 23	May 9	May 26
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 8	Sept. 19	Sept. 12
2 years in 10 earlier than--	Oct. 13	Sept. 25	Sept. 16
5 years in 10 earlier than--	Oct. 24	Oct. 6	Sept. 25
BALDWIN:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 14	May 27	June 14
2 years in 10 later than--	May 10	May 22	June 9
5 years in 10 later than--	May 3	May 13	May 29
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 3	Sept. 17	Sept. 4
2 years in 10 earlier than--	Oct. 8	Sept. 22	Sept. 8
5 years in 10 earlier than--	Oct. 18	Sept. 30	Sept. 17

TABLE 2.--FREEZE DATES IN SPRING AND FALL--Continued

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
BIG RAPIDS:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 3	May 19	June 2
2 years in 10 later than--	Apr. 29	May 14	May 29
5 years in 10 later than--	Apr. 20	May 4	May 20
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 5	Sept. 23	Sept. 11
2 years in 10 earlier than--	Oct. 12	Sept. 28	Sept. 16
5 years in 10 earlier than--	Oct. 24	Oct. 8	Sept. 25

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Hesperia, in Oceana County; Baldwin, in Lake County; and Big Rapids, in Mecosta County)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
HESPERIA:			
9 years in 10	160	128	102
8 years in 10	168	135	109
5 years in 10	184	149	121
2 years in 10	199	163	134
1 year in 10	207	171	140
BALDWIN:			
9 years in 10	145	124	91
8 years in 10	153	129	98
5 years in 10	167	139	111
2 years in 10	182	150	124
1 year in 10	190	155	131
BIG RAPIDS:			
9 years in 10	160	138	110
8 years in 10	169	144	116
5 years in 10	187	157	128
2 years in 10	204	169	139
1 year in 10	213	176	145

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
2	Glendora mucky sand	17,497	3.2
3	Adrian muck	16,122	2.9
4A	Cosad loamy sand, 0 to 3 percent slopes	5,734	1.0
5B	Pipestone sand, 0 to 4 percent slopes	20,632	3.7
8	Cohoctah fine sandy loam	3,058	0.6
10B	Sparta sand, 0 to 6 percent slopes	4,903	0.9
10B3	Sparta sand, 0 to 6 percent slopes, severely eroded	962	0.2
10C	Sparta sand, 6 to 12 percent slopes	407	0.1
11	Martisco muck	2,210	0.4
13B	Selfridge-Capac complex, 0 to 5 percent slopes	6,831	1.2
14B	Dixboro loamy fine sand, 0 to 4 percent slopes	1,032	0.2
15B	Capac loam, 0 to 5 percent slopes	3,936	0.7
16	Napoleon peat	1,588	0.3
17B	Spinks-Metea-Coloma complex, 1 to 6 percent slopes	5,723	1.0
17C	Spinks-Metea-Coloma complex, 6 to 12 percent slopes	8,057	1.5
17D	Spinks-Metea complex, 12 to 25 percent slopes	2,592	0.5
19B	Covert sand, 0 to 4 percent slopes	20,189	3.7
20	Granby mucky sand	2,474	0.4
21	Kingsville mucky sand	18,339	3.3
22B	Scalley loam, 1 to 6 percent slopes	1,070	0.2
22C	Scalley loam, 6 to 12 percent slopes	525	0.1
22D	Scalley loam, 12 to 18 percent slopes	120	*
23	Lamson loamy fine sand	1,478	0.3
24	Edwards muck	1,170	0.2
27	Granby mucky sand, gravelly substratum	2,059	0.4
28B	Watseka loamy sand, 0 to 4 percent slopes	1,789	0.3
29B	Coloma sand, 0 to 6 percent slopes	29,297	5.3
29C	Coloma sand, 6 to 12 percent slopes	29,535	5.4
29D	Coloma sand, 12 to 30 percent slopes	8,745	1.6
32	Carlisle muck	7,955	1.4
36B	Del Rey loam, 0 to 4 percent slopes	4,365	0.8
39B	Boyer loamy sand, 0 to 6 percent slopes	5,589	1.0
39C	Boyer loamy sand, 6 to 12 percent slopes	1,541	0.3
39D	Boyer loamy sand, 12 to 18 percent slopes	594	0.1
39E	Boyer loamy sand, 18 to 40 percent slopes	382	0.1
40B	Tustin loamy sand, 1 to 6 percent slopes	1,877	0.3
40C	Tustin loamy sand, 6 to 12 percent slopes	834	0.2
41B	Marlette loam, moderately wet, 1 to 6 percent slopes	10,090	1.8
41C	Marlette loam, 6 to 12 percent slopes	5,674	1.0
41C2	Marlette loam, 6 to 12 percent slopes, eroded	1,318	0.2
41D	Marlette loam, 12 to 18 percent slopes	947	0.2
42B	Metea-Marlette-Spinks complex, 1 to 6 percent slopes	10,415	1.9
42C	Metea-Marlette-Spinks complex, 6 to 12 percent slopes	10,207	1.8
42C2	Metea-Marlette-Spinks complex, 6 to 12 percent slopes, eroded	1,549	0.3
42D	Metea-Spinks-Marlette complex, 12 to 25 percent slopes	1,655	0.3
42E	Metea-Spinks complex, 25 to 40 percent slopes	1,269	0.2
43B	Metea loamy sand, 1 to 6 percent slopes	8,005	1.5
43C	Metea loamy sand, 6 to 12 percent slopes	5,894	1.1
44B	Spinks loamy sand, 0 to 6 percent slopes	8,877	1.6
44C	Spinks loamy sand, 6 to 12 percent slopes	7,212	1.3
44D	Spinks loamy sand, 12 to 18 percent slopes	1,601	0.3
44E	Spinks loamy sand, 18 to 40 percent slopes	436	0.1
46B	Perrinton loam, 1 to 6 percent slopes	1,683	0.3
46C	Perrinton loam, 6 to 12 percent slopes	790	0.1
46D	Perrinton loam, 12 to 18 percent slopes	216	*
46F	Perrinton loam, 35 to 70 percent slopes	349	0.1
47B	Toogood loamy sand, 0 to 6 percent slopes	7,416	1.3
47C	Toogood loamy sand, 6 to 12 percent slopes	1,148	0.2
47D	Toogood loamy sand, 12 to 18 percent slopes	791	0.1
49B	Toogood loamy sand, moderately wet, 0 to 4 percent slopes	3,748	0.7
51B	Thetford loamy fine sand, 0 to 4 percent slopes	6,716	1.2
52	Linwood muck	527	0.1
53	Parkhill loam	1,378	0.3

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
55	Sickles loamy fine sand	3,063	0.6
60B	Grattan sand, 0 to 6 percent slopes	10,020	1.8
60C	Grattan sand, 6 to 18 percent slopes	5,663	1.0
60D	Grattan sand, 18 to 35 percent slopes	1,899	0.3
62	Jebavy sand	393	0.1
65	Wauseon loam	1,339	0.2
70	Udorthents, loamy, nearly level and gently sloping	141	*
72	Udipsamments, nearly level and gently sloping	895	0.2
82	Algansee loamy fine sand	3,453	0.6
88	Ceresco fine sandy loam	609	0.1
90	Histosols and Aquents, ponded	4,710	0.9
91B	Plainfield sand, 0 to 6 percent slopes	54,006	9.8
91C	Plainfield sand, 6 to 18 percent slopes	12,020	2.2
91D	Plainfield sand, 18 to 35 percent slopes	5,056	0.9
91F	Plainfield sand, 35 to 50 percent slopes	1,599	0.3
92B	Selfridge loamy sand, 0 to 4 percent slopes	5,964	1.1
93	Pits, sand and gravel	886	0.2
94B	Brems sand, 0 to 4 percent slopes	24,689	4.5
95A	Abscota loamy sand, 0 to 3 percent slopes	941	0.2
96A	Pipestone-Kingsville complex, 0 to 3 percent slopes	5,510	1.0
97B	Urban land-Metea-Marlette complex, 0 to 8 percent slopes	1,117	0.2
98F	Plainfield-Perrinton complex, 35 to 70 percent slopes	3,408	0.6
111B	Plainfield sand, banded substratum, 0 to 6 percent slopes	1,383	0.3
111C	Plainfield sand, banded substratum, 6 to 18 percent slopes	249	*
112B	Plainfield sand, wet substratum, 0 to 6 percent slopes	3,296	0.6
115B	Plainfield, banded substratum-Plainfield, loamy substratum, complex, 0 to 6 percent slopes	452	0.1
121B	Grattan sand, banded substratum, 0 to 6 percent slopes	2,546	0.5
121C	Grattan sand, banded substratum, 6 to 18 percent slopes	1,600	0.3
122B	Grattan sand, wet substratum, 0 to 6 percent slopes	6,454	1.2
125B	Grattan, banded substratum-Spinks complex, 0 to 6 percent slopes	2,418	0.4
125C	Grattan, banded substratum-Spinks complex, 6 to 18 percent slopes	1,314	0.2
125E	Grattan, banded substratum-Spinks complex, 18 to 30 percent slopes	81	*
130B	Grattan-Coloma complex, 0 to 6 percent slopes	1,832	0.3
130C	Grattan-Coloma complex, 6 to 18 percent slopes	939	0.2
130E	Grattan-Coloma complex, 18 to 30 percent slopes	252	*
131B	Grattan, banded substratum-Coloma complex, 0 to 6 percent slopes	608	0.1
131C	Grattan, banded substratum-Coloma complex, 6 to 18 percent slopes	1,608	0.3
131E	Grattan, banded substratum-Coloma complex, 18 to 30 percent slopes	143	*
135B	Grattan, banded substratum-Metea complex, 0 to 6 percent slopes	5,672	1.0
135C	Grattan, banded substratum-Metea complex, 6 to 18 percent slopes	7,580	1.4
135E	Grattan, banded substratum-Metea complex, 18 to 30 percent slopes	1,251	0.2
135F	Grattan, banded substratum-Metea complex, 30 to 60 percent slopes	284	0.1
137B	Metea-Tustin complex, 0 to 6 percent slopes	543	0.1
137C	Metea-Tustin complex, 6 to 18 percent slopes	1,342	0.2
147C	Marlette-Metea complex, 0 to 18 percent slopes	83	*
181	Histosols, dysic	4,033	0.7
182	Histosols, euic	7,531	1.4
	Water	9,760	1.8
	Total	551,757	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
4A	Cosad loamy sand, 0 to 3 percent slopes
13B	Selfridge-Capac complex, 0 to 5 percent slopes (where drained)
14B	Dixboro loamy fine sand, 0 to 4 percent slopes (where drained)
15B	Capac loam, 0 to 5 percent slopes (where drained)
22B	Scalley loam, 1 to 6 percent slopes
23	Lamson loamy fine sand (where drained)
36B	Del Rey loam, 0 to 4 percent slopes (where drained)
40B	Tustin loamy sand, 1 to 6 percent slopes
41B	Marlette loam, moderately wet, 1 to 6 percent slopes
42B	Metea-Marlette-Spinks complex, 1 to 6 percent slopes
43B	Metea loamy sand, 1 to 6 percent slopes
46B	Perrinton loam, 1 to 6 percent slopes
53	Parkhill loam (where drained)
65	Wauseon loam (where drained)
88	Ceresco fine sandy loam (where protected from flooding or not frequently flooded during the growing season)
92B	Selfridge loamy sand, 0 to 4 percent slopes

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Corn silage	Alfalfa hay	Winter wheat	Oats	Bromegrass-alfalfa hay
		Bu	Tons	Tons	Bu	Bu	Tons
2--------------- Glendora	VIw	---	---	---	---	---	---
3--------------- Adrian	IVw	90	17	---	---	---	---
4A-------------- Cosad	IIIw	85	17	4.2	40	75	2.9
5B-------------- Pipestone	IVw	65	12	3.5	30	60	---
8--------------- Cohoctah	Vw	---	---	---	---	---	---
10B------------- Sparta	IVs	46	7	---	25	43	2.7
10B3------------ Sparta	VIs	---	---	---	---	---	---
10C------------- Sparta	VIs	---	---	---	---	40	2.5
11-------------- Martisco	IIIw	95	16	---	---	---	---
13B------------- Selfridge-Capac	IIIe	110	18	4.8	49	85	3.3
14B------------- Dixboro	IIw	115	19	4.5	50	95	3.2
15B------------- Capac	IIe	110	17	5.5	62	95	3.8
16-------------- Napoleon	VIw	---	---	---	---	---	---
17B------------- Spinks-Metea-Coloma	IIIs	80	---	---	30	60	2.8
17C------------- Spinks-Metea-Coloma	IIIe	75	---	---	25	50	2.5
17D------------- Spinks-Metea	VIe	---	---	---	---	---	---
19B------------- Covert	IVs	70	13	3.5	40	60	2.5
20-------------- Granby	IVw	75	14	---	40	60	---

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Alfalfa hay	Winter wheat	Oats	Bromegrass-alfalfa hay
		Bu	Tons	Tons	Bu	Bu	Tons
21-------------- Kingsville	Vw	---	---	---	---	---	---
22B------------- Scalley	IIe	115	18	4.8	55	85	3.4
22C------------- Scalley	IIIe	110	15	4.7	50	75	3.2
22D------------- Scalley	IVe	90	14	4.0	42	70	2.7
23-------------- Lamson	Vw	---	---	---	---	---	---
24-------------- Edwards	IVw	90	16	---	---	---	---
27-------------- Granby	Vw	---	---	---	---	---	---
28B------------- Watseka	IIIs	90	16	---	43	62	---
29B------------- Coloma	IVs	45	7	3.0	25	45	2.5
29C------------- Coloma	VIs	---	---	2.7	23	40	2.2
29D------------- Coloma	VIIs	---	---	---	---	---	---
32-------------- Carlisle	IIIw	90	16	---	---	80	---
36B------------- Del Rey	IIe	113	---	---	48	68	---
39B------------- Boyer	IIIs	80	14	3.8	35	60	2.7
39C------------- Boyer	IIIe	75	12	3.4	32	55	2.4
39D------------- Boyer	IVe	65	11	3.2	27	50	2.2
39E------------- Boyer	VIIe	---	---	---	---	---	---
40B------------- Tustin	IIIe	80	13	4.0	40	60	2.8
40C------------- Tustin	IVe	75	12	3.8	36	55	2.6
41B------------- Marlette	IIe	120	19	5.0	60	95	3.5

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Alfalfa hay	Winter wheat	Oats	Bromegrass-alfalfa hay
		Bu	Tons	Tons	Bu	Bu	Tons
41C------------- Marlette	IIIe	110	15	4.7	56	90	3.2
41C2------------ Marlette	IIIe	90	14	3.8	45	75	2.5
41D------------- Marlette	IVe	85	13	4.0	48	65	2.7
42B------------- Metea-Marlette-Spinks	IIIe	100	---	4.0	49	60	3.2
42C------------- Metea-Marlette-Spinks	IIIe	87	16	3.6	43	55	2.7
42C2------------ Metea-Marlette-Spinks	IIIe	79	14	3.5	38	53	2.5
42D------------- Metea-Spinks-Marlette	IVe	---	---	---	---	---	1.9
42E------------- Metea-Spinks	VIIe	---	---	---	---	---	---
43B------------- Metea	IIIe	85	---	---	42	60	---
43C------------- Metea	IIIe	75	---	---	38	55	---
44B------------- Spinks	IIIs	75	13	3.5	30	60	3.0
44C------------- Spinks	IIIe	68	12	3.3	28	55	2.4
44D------------- Spinks	IVe	---	---	---	24	50	1.8
44E------------- Spinks	VIIe	---	---	---	---	---	---
46B------------- Perrinton	IIe	110	18	5.0	55	85	3.5
46C------------- Perrinton	IIIe	95	16	4.5	45	80	3.2
46D------------- Perrinton	IVe	80	14	3.6	38	70	2.5
46F------------- Perrinton	VIIe	---	---	---	---	---	---
47B------------- Toogood	IVs	55	11	---	25	45	2.1

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Alfalfa hay	Winter wheat	Oats	Bromegrass-alfalfa hay
		Bu	Tons	Tons	Bu	Bu	Tons
47C------------- Toogood	VIs	---	---	---	---	---	---
47D------------- Toogood	VIs	---	---	---	---	---	---
49B------------- Toogood	IVs	55	11	3.0	25	45	2.1
51B------------- Thetford	IIIw	85	14	3.8	35	65	3.0
52-------------- Linwood	Vw	---	---	---	---	---	---
53-------------- Parkhill	IIw	140	22	4.2	65	115	---
55-------------- Sickles	IIIw	115	19	4.5	50	90	3.2
60B------------- Grattan	VIs	---	---	---	---	---	2.0
60C, 60D-------- Grattan	VIIs	---	---	---	---	---	---
62-------------- Jebavy	Vw	---	---	---	---	---	---
65-------------- Wauseon	IIIw	100	---	5.0	40	70	3.5
70. Udorthents							
72. Udipsamments							
82-------------- Algansee	IIIw	85	14	3.8	35	65	2.7
88-------------- Ceresco	IIIw	115	20	4.0	50	95	2.8
90. Histosols and Aquents							
91B------------- Plainfield	IVs	---	---	---	---	---	---
91C------------- Plainfield	VIs	---	---	---	---	---	---
91D, 91F-------- Plainfield	VIIs	---	---	---	---	---	---
92B------------- Selfridge	IIIe	110	18	4.2	38	75	3.0

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Alfalfa hay	Winter wheat	Oats	Bromegrass-alfalfa hay
		Bu	Tons	Tons	Bu	Bu	Tons
93. Pits							
94B------------- Brems	IVs	70	16	---	32	45	2.3
95A------------- Abscota	IVs	80	14	3.5	30	60	2.4
96A------------- Pipestone-Kingsville	IVw	---	---	---	---	---	---
97B. Urban land-Metea-Marlette							
98F------------- Plainfield-Perrinton	VIIs	---	---	---	---	---	---
111B------------ Plainfield	IVs	45	7	---	---	---	---
111C------------ Plainfield	VIIs	---	---	---	---	---	---
112B------------ Plainfield	IVs	---	---	---	---	---	---
115B------------ Plainfield, banded substratum-Plainfield, loamy substratum	IVs	---	---	---	---	---	---
121B------------ Grattan	VIs	---	---	---	---	---	---
121C------------ Grattan	VIIs	---	---	---	---	---	---
122B------------ Grattan	VIs	---	---	---	---	---	---
125B------------ Grattan-Spinks	VIs	---	---	---	---	---	---
125C------------ Grattan-Spinks	VIIs	---	---	---	---	---	---
125E------------ Grattan-Spinks	VIIs	---	---	---	---	---	---
130B------------ Grattan-Coloma	VIs	---	---	---	---	---	---
130C------------ Grattan-Coloma	VIIs	---	---	---	---	---	---

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Alfalfa hay	Winter wheat	Oats	Bromegrass-alfalfa hay
		Bu	Tons	Tons	Bu	Bu	Tons
130E------------ Grattan-Coloma	VIIs	---	---	---	---	---	---
131B------------ Grattan-Coloma	VIs	---	---	---	---	---	---
131C------------ Grattan-Coloma	VIIs	---	---	---	---	---	---
131E------------ Grattan-Coloma	VIIs	---	---	---	---	---	---
135B------------ Grattan-Metea	VIs	---	---	---	---	---	---
135C------------ Grattan-Metea	VIIs	---	---	---	---	---	---
135E------------ Grattan-Metea	VIIs	---	---	---	---	---	---
135F------------ Grattan-Metea	VIIs	---	---	---	---	---	---
137B------------ Metea-Tustin	IIIe	83	---	---	---	---	---
137C------------ Metea-Tustin	IVe	---	---	---	---	---	---
147C------------ Marlette-Metea	IIIe	96	---	---	49	---	---
181------------- Histosols	VIw	---	---	---	---	---	---
182------------- Histosols	Vw	---	---	---	---	---	---

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	---	---	---	---
II	23,554	21,144	2,410	---
III	130,235	77,178	31,079	21,978
IV	195,479	5,967	45,908	143,604
V	25,854	---	25,854	---
VI	108,962	3,861	30,649	74,511
VII	51,149	8,583	---	42,566
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
2---------------Glendora	3W	Slight	Severe	Moderate	Moderate	Silver maple--------	90	42	---
						Red maple-----------	65	40	
						Swamp white oak-----	---	---	
						Quaking aspen-------	---	---	
						White ash-----------	65	59	
3---------------Adrian	2W	Slight	Severe	Severe	Severe	Silver maple--------	78	32	---
						Red maple-----------	53	34	
						Quaking aspen-------	60	64	
						Tamarack------------	45	35	
						Green ash-----------	69	64	
						Northern whitecedar-	---	---	
4A--------------Cosad	3W	Slight	Moderate	Moderate	Moderate	Red maple-----------	70	43	Norway spruce, white spruce, eastern white pine, northern whitecedar.
						Eastern white pine--	70	51	
						Quaking aspen-------	---	---	
5B--------------Pipestone	3W	Slight	Severe	Moderate	Moderate	Red maple-----------	65	40	White spruce, eastern white pine.
						White ash-----------	---	---	
						Eastern cottonwood--	---	---	
						Eastern white pine--	64	133	
						American basswood---	56	44	
						Quaking aspen-------	---	---	
8---------------Cohoctah	2W	Slight	Severe	Moderate	Moderate	Red maple-----------	56	36	Eastern white pine, white spruce, northern whitecedar.
						Silver maple--------	80	34	
						White ash-----------	---	---	
						Swamp white oak-----	---	---	
10B, 10B3, 10C--Sparta	6S	Slight	Moderate	Moderate	Slight	Jack pine-----------	55	77	Red pine, eastern white pine.
						Northern red oak----	47	30	
						Black oak-----------	---	---	
11--------------Martisco	2W	Slight	Severe	Severe	Severe	Red maple-----------	55	35	---
13B**:									
Selfridge------	6W	Slight	Moderate	Slight	Slight	Quaking aspen-------	70	81	Eastern white pine, white spruce, imperial Carolina poplar.
						American beech------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Sugar maple---------	---	---	
						Black cherry--------	---	---	
						American basswood---	---	---	
						Bigtooth aspen------	---	---	
Capac----------	4W	Slight	Moderate	Slight	Slight	Northern red oak----	65	59	Eastern white pine, white spruce, northern red oak.
						American basswood---	---	---	
						White ash-----------	---	---	
						Red maple-----------	---	---	
						Sugar maple---------	---	---	
						Black cherry--------	---	---	
						American beech------	---	---	
						Quaking aspen-------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
14B------------- Dixboro	4W	Slight	Moderate	Slight	Slight	Northern red oak----	65	59	Eastern white pine, white spruce, northern red oak.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Shagbark hickory----	---	---	
						American basswood---	---	---	
						Red maple-----------	---	---	
15B------------- Capac	4W	Slight	Moderate	Slight	Slight	Northern red oak----	65	59	Eastern white pine, white spruce, northern red oak.
						American basswood---	---	---	
						White ash-----------	---	---	
						Red maple-----------	---	---	
						Sugar maple---------	---	---	
						Black cherry--------	---	---	
						American beech------	---	---	
						Quaking aspen-------	---	---	
16-------------- Napoleon	2W	Slight	Severe	Severe	Severe	Red maple-----------	56	36	Tamarack.
						Quaking aspen-------	---	---	
						Tamarack------------	---	---	
17B**, 17C**:									
Spinks---------	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
						Red maple-----------	---	---	
Metea----------	4A	Slight	Slight	Slight	Slight	White oak-----------	80	80	Eastern white pine, red pine, black walnut.
						Eastern white pine--	75	166	
						Red pine------------	75	142	
						Red maple-----------	---	---	
						Sugar maple---------	---	---	
Coloma---------	2S	Slight	Moderate	Moderate	Slight	Northern pin oak----	49	33	Red pine, eastern white pine.
						Jack pine-----------	---	---	
						Eastern white pine--	---	---	
						Black oak-----------	---	---	
						Red maple-----------	---	---	
17D**:									
Spinks---------	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
						Sugar maple---------	---	---	
						Red maple-----------	---	---	
Metea----------	4R	Moderate	Moderate	Slight	Slight	White oak-----------	80	80	Eastern white pine, red pine, black walnut.
						Eastern white pine--	75	166	
						Red pine------------	75	142	
19B------------- Covert	4S	Slight	Moderate	Moderate	Slight	Northern red oak----	67	61	Red pine.
						Red maple-----------	66	41	
						Black cherry--------	---	---	
						American basswood---	---	---	
						White oak-----------	---	---	
						Quaking aspen-------	---	---	
						American beech------	---	---	
						Eastern white pine--	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
20-------------- Granby	2W	Slight	Severe	Severe	Severe	Silver maple--------	82	36	Eastern white pine, white spruce, Austrian pine, northern whitecedar.
						Red maple-----------	68	42	
						American basswood---	---	---	
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
21-------------- Kingsville	5W	Slight	Severe	Severe	Severe	Bigtooth aspen------	67	76	White spruce, eastern white pine.
						Red maple-----------	65	40	
						Quaking aspen-------	67	76	
						Swamp white oak-----	63	46	
						Silver maple--------	---	---	
						White ash-----------	---	---	
						Green ash-----------	---	---	
22B, 22C, 22D--- Scalley	3A	Slight	Slight	Slight	Slight	Sugar maple---------	61	38	White spruce, eastern white pine, red pine, black walnut.
						Northern red oak----	---	---	
						Black cherry--------	---	---	
						White ash-----------	---	---	
						White oak-----------	---	---	
23-------------- Lamson	8W	Slight	Severe	Severe	Severe	Eastern white pine--	65	136	Northern whitecedar, eastern white pine, white spruce.
						Red maple-----------	65	40	
						Swamp white oak-----	---	---	
						Quaking aspen-------	---	---	
24-------------- Edwards	2W	Slight	Severe	Severe	Severe	Red maple-----------	56	36	---
						White ash-----------	---	---	
						Green ash-----------	---	---	
						Swamp white oak-----	---	---	
						Silver maple--------	---	---	
27-------------- Granby	2W	Slight	Severe	Severe	Severe	Silver maple--------	82	36	White spruce, eastern white pine, northern whitecedar.
						Red maple-----------	68	42	
						American basswood---	---	---	
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
28B------------- Watseka	6W	Slight	Moderate	Slight	Slight	Quaking aspen-------	70	81	White spruce, Norway spruce, eastern white pine, European larch.
						Red maple-----------	---	---	
						Eastern white pine--	---	---	
29B, 29C, 29D--- Coloma	2S	Slight	Moderate	Moderate	Slight	Northern pin oak----	49	33	Red pine, eastern white pine.
						Jack pine-----------	---	---	
						Eastern white pine--	---	---	
						Black oak-----------	---	---	
						Red maple-----------	---	---	
32-------------- Carlisle	2W	Slight	Severe	Severe	Severe	Red maple-----------	56	36	---
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Swamp white oak-----	---	---	
						Silver maple--------	82	36	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
36B------------- Del Rey	3C	Slight	Moderate	Severe	Severe	Northern red oak----	56	44	Northern red oak, northern whitecedar, white spruce, eastern white pine, imperial Carolina poplar.
						White ash-----------	56	44	
						Red maple-----------	56	36	
						White oak-----------	56	44	
						American basswood---	56	44	
39B, 39C, 39D--- Boyer	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, northern red oak, white oak, white spruce.
						White oak-----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Black oak-----------	---	---	
39E------------- Boyer	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Eastern white pine, red pine, northern red oak, white oak, white spruce.
						White oak-----------	---	---	
						American basswood---	---	---	
						Sugar maple---------	---	---	
						Black oak-----------	---	---	
40B, 40C-------- Tustin	3A	Slight	Slight	Slight	Slight	Black oak-----------	55	38	Red pine, eastern white pine, Norway spruce.
						Red pine------------	---	---	
						Eastern white pine--	---	---	
						Northern red oak----	---	---	
41B, 41C, 41C2, 41D------------ Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Black walnut, eastern white pine, red pine, white spruce.
						Northern red oak----	69	64	
						White ash-----------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
						Eastern white pine--	---	---	
						American beech------	---	---	
42B**, 42C**, 42C2**:									
Metea---------	4A	Slight	Slight	Slight	Slight	White oak-----------	80	80	Eastern white pine, red pine, black walnut.
						Eastern white pine--	75	166	
						Red pine------------	75	142	
						Red maple-----------	---	---	
						Sugar maple---------	---	---	
Marlette------	3A	Slight	Slight	Slight	Slight	Sugar maple---------	65	40	Black walnut, eastern white pine, red pine, white spruce.
						Northern red oak----	69	64	
						White ash-----------	---	---	
						American basswood---	---	---	
						Black cherry--------	---	---	
						White oak-----------	---	---	
Spinks--------	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine, imperial Carolina poplar.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
42D**:									
Metea	4R	Moderate	Moderate	Slight	Slight	White oak	80	80	Eastern white pine, red pine, black walnut.
						Eastern white pine	75	166	
						Red pine	75	142	
						Red maple	---	---	
						Sugar maple	---	---	
Spinks	4R	Moderate	Moderate	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
						Red maple	---	---	
Marlette	3R	Moderate	Moderate	Slight	Slight	Sugar maple	65	40	Black walnut, eastern white pine, red pine, white spruce.
						Northern red oak	69	64	
						White ash	---	---	
						American basswood	---	---	
						Black cherry	---	---	
						White oak	---	---	
						Eastern white pine	---	---	
						American beech	---	---	
42E**:									
Metea	4R	Severe	Severe	Slight	Slight	White oak	80	80	Eastern white pine, red pine, black walnut.
						Eastern white pine	75	166	
						Red pine	75	142	
						Red maple	---	---	
						Sugar maple	---	---	
Spinks	4R	Moderate	Moderate	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
						Red maple	---	---	
43B, 43C Metea	4A	Slight	Slight	Slight	Slight	White oak	80	80	Eastern white pine, red pine, black walnut.
						Eastern white pine	75	166	
						Red pine	75	142	
						Red maple	---	---	
						Sugar maple	---	---	
44B, 44C, 44D Spinks	4A	Slight	Slight	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
						Red maple	---	---	
44E Spinks	4R	Moderate	Moderate	Slight	Slight	Northern red oak	66	60	Red pine, eastern white pine.
						White oak	---	---	
						Black oak	---	---	
						Black cherry	---	---	
						Red maple	---	---	
46B, 46C, 46D Perrinton	4A	Slight	Slight	Slight	Slight	Northern red oak	65	59	White spruce, eastern white pine, northern whitecedar, northern red oak.
						Sugar maple	---	---	
						Red maple	---	---	
						White ash	---	---	
						American basswood	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
46F------------- Perrinton	4R	Severe	Severe	Slight	Slight	Northern red oak----	65	59	White spruce, eastern white pine, northern whitecedar, northern red oak.
						Sugar maple---------	---	---	
						Red maple-----------	---	---	
						White ash-----------	---	---	
						American basswood---	---	---	
47B, 47C, 47D, 49B------------ Toogood	6A	Slight	Slight	Slight	Slight	Red pine------------	55	88	Red pine, eastern white pine.
						White oak-----------	---	---	
						Northern red oak----	---	---	
						Quaking aspen-------	---	---	
						Black oak-----------	---	---	
51B------------- Thetford	3W	Slight	Moderate	Slight	Slight	Red maple-----------	65	40	White spruce, eastern white pine.
						White ash-----------	---	---	
						Quaking aspen-------	---	---	
						Northern red oak----	---	---	
						Swamp white oak-----	---	---	
52-------------- Linwood	2W	Slight	Severe	Severe	Severe	Red maple-----------	56	36	---
						Silver maple--------	82	36	
						Quaking aspen-------	---	---	
53-------------- Parkhill	3W	Slight	Severe	Severe	Severe	Red maple-----------	66	41	Eastern white pine, white spruce.
						Silver maple--------	91	43	
						Pin oak-------------	---	---	
						White ash-----------	66	60	
						American basswood---	66	60	
						Swamp white oak-----	---	---	
55-------------- Sickles	5W	Slight	Severe	Severe	Severe	Quaking aspen-------	61	66	White spruce, eastern white pine.
						White ash-----------	---	---	
						Eastern cottonwood--	---	---	
						American basswood---	---	---	
						Red maple-----------	---	---	
						Swamp white oak-----	---	---	
						Eastern white pine--	---	---	
60B, 60C-------- Grattan	9S	Slight	Moderate	Moderate	Slight	Eastern white pine--	62	127	Red pine, eastern white pine.
						Quaking aspen-------	---	---	
						White oak-----------	52	37	
						Black oak-----------	60	43	
						Northern red oak----	61	53	
						Red maple-----------	---	---	
60D------------- Grattan	9R	Moderate	Moderate	Moderate	Slight	Eastern white pine--	62	127	Red pine, eastern white pine.
						Quaking aspen-------	---	---	
						White oak-----------	52	37	
						Black oak-----------	60	43	
						Northern red oak----	61	53	
						Red maple-----------	---	---	
62-------------- Jebavy	2W	Slight	Severe	Moderate	Severe	Red maple-----------	45	30	Eastern white pine, white spruce.
						Eastern cottonwood--	---	---	
						Black spruce--------	---	---	
						White ash-----------	---	---	
						Paper birch---------	56	59	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
65-------------- Wauseon	2W	Slight	Severe	Severe	Severe	Silver maple--------	80	34	Silver maple.
						White ash-----------	---	---	
						Swamp white oak-----	---	---	
82-------------- Algansee	4W	Slight	Severe	Slight	Slight	Quaking aspen-------	60	64	White spruce, eastern white pine.
						Silver maple--------	78	32	
						Swamp white oak-----	---	---	
						White ash-----------	---	---	
						Red maple-----------	56	36	
88-------------- Ceresco	4W	Slight	Moderate	Slight	Slight	Northern red oak----	66	60	Eastern white pine, white spruce, black walnut, northern red oak, Norway spruce.
						White ash-----------	---	---	
						Red maple-----------	---	---	
						Silver maple--------	---	---	
						Black walnut--------	---	---	
91B, 91C-------- Plainfield	8S	Slight	Moderate	Moderate	Slight	Eastern white pine--	58	115	Red pine.
						Red pine------------	55	88	
						Jack pine-----------	49	65	
						Black oak-----------	50	34	
						White oak-----------	42	28	
91D------------- Plainfield	8R	Moderate	Moderate	Moderate	Slight	Eastern white pine--	58	115	Red pine.
						Red pine------------	55	88	
						Jack pine-----------	49	65	
						Black oak-----------	50	34	
						White oak-----------	42	28	
91F------------- Plainfield	8R	Severe	Severe	Severe	Slight	Eastern white pine--	58	115	Red pine.
						Red pine------------	55	88	
						Jack pine-----------	49	65	
						Black oak-----------	50	34	
						White oak-----------	42	24	
92B------------- Selfridge	6W	Slight	Moderate	Slight	Slight	Quaking aspen-------	70	81	Eastern white pine, white spruce, imperial Carolina poplar.
						American beech------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
						Sugar maple---------	---	---	
						Black cherry--------	---	---	
						American basswood---	---	---	
94B------------- Brems	3S	Slight	Moderate	Moderate	Slight	Pin oak-------------	59	32	Eastern white pine, red pine, jack pine.
						Black oak-----------	---	---	
						White oak-----------	---	---	
						Jack pine-----------	55	77	
						Red maple-----------	---	---	
95A------------- Abscota	4S	Slight	Moderate	Moderate	Slight	Northern red oak----	66	60	Eastern white pine, northern red oak.
						White ash-----------	---	---	
						Silver maple--------	---	---	
96A**:									
Pipestone------	3W	Slight	Severe	Moderate	Moderate	Red maple-----------	65	60	White spruce, eastern white pine.
						White ash-----------	---	---	
						Eastern white pine--	64	133	
						American basswood---	56	44	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
96A**:									
Kingsville	5W	Slight	Severe	Severe	Severe	Bigtooth aspen	67	76	White spruce, eastern white pine.
						Red maple	65	40	
						Quaking aspen	67	76	
						Swamp white oak	63	46	
						Silver maple	---	---	
						White ash	---	---	
98F**:									
Plainfield	8R	Severe	Severe	Severe	Slight	Eastern white pine	58	115	Red pine, eastern white pine, jack pine.
						Red pine	55	88	
						Jack pine	49	65	
						Northern pin oak	48	33	
						Black oak	---	---	
Perrinton	4R	Severe	Severe	Slight	Slight	Northern red oak	65	59	White spruce, eastern white pine, northern whitecedar, northern red oak.
						Sugar maple	---	---	
						Red maple	---	---	
						White ash	---	---	
						American basswood	---	---	
						Eastern white pine	---	---	
111B, 111C Plainfield	3S	Slight	Moderate	Moderate	Slight	Black oak	55	38	Red pine, jack pine, eastern white pine.
						White oak	50	34	
						Eastern white pine	58	115	
						Bigtooth aspen	---	---	
						Jack pine	---	---	
						Red pine	55	88	
112B Plainfield	3S	Slight	Moderate	Moderate	Slight	Black oak	55	38	Red pine, eastern white pine, jack pine.
						White oak	50	34	
						Eastern white pine	58	115	
						Bigtooth aspen	---	---	
						Jack pine	---	---	
						Red pine	55	88	
						Northern red oak	55	42	
115B**:									
Plainfield, banded substratum	3S	Slight	Moderate	Moderate	Slight	Black oak	55	38	Red pine, jack pine, eastern white pine.
						White oak	50	34	
						Eastern white pine	58	115	
						Bigtooth aspen	---	---	
						Jack pine	---	---	
						Red pine	55	88	
Plainfield, loamy substratum	8S	Slight	Moderate	Moderate	Slight	Eastern white pine	58	115	Red pine, eastern white pine, jack pine, Norway spruce.
						Red pine	58	96	
						Jack pine	---	---	
						Northern pin oak	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
121B, 121C------ Grattan	4S	Slight	Moderate	Moderate	Slight	White oak-----------	53	59	Red pine, eastern white pine.
						Black oak-----------	66	54	
						Northern red oak----	65	69	
						Red maple-----------	62	39	
						Eastern white pine--	62	127	
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
122B----------- Grattan	4S	Slight	Moderate	Moderate	Slight	White oak-----------	65	59	Red pine, eastern white pine.
						Black oak-----------	72	54	
						Eastern white pine--	62	127	
						Quaking aspen-------	---	---	
						Red maple-----------	---	---	
						Red pine------------	---	---	
125B**, 125C**:									
Grattan--------	4S	Slight	Moderate	Moderate	Slight	White oak-----------	65	59	Red pine, eastern white pine.
						Black oak-----------	72	54	
						Northern red oak----	72	69	
						Red maple-----------	62	39	
						Eastern white pine--	62	127	
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
Spinks---------	4A	Slight	Slight	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
125E**:									
Grattan--------	4R	Moderate	Moderate	Moderate	Slight	White oak-----------	65	59	Red pine, eastern white pine.
						Northern red oak----	72	69	
						Red maple-----------	62	39	
						Eastern white pine--	62	127	
						Quaking aspen-------	---	---	
						Red pine------------	---	---	
Spinks---------	4R	Moderate	Moderate	Slight	Slight	Northern red oak----	66	60	Red pine, eastern white pine.
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Black cherry--------	---	---	
						Red maple-----------	---	---	
						Quaking aspen-------	---	---	
130B**									
Grattan--------	9S	Slight	Moderate	Moderate	Slight	Eastern white pine--	62	127	Red pine, eastern white pine.
						Quaking aspen-------	---	---	
						White oak-----------	---	---	
						Black oak-----------	---	---	
						Northern red oak----	---	---	
						Red maple-----------	---	---	
Coloma---------	2S	Slight	Moderate	Moderate	Slight	Northern pin oak----	49	33	Red pine, eastern white pine.
						Eastern white pine--	---	---	
						Red maple-----------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
130C**:									
Grattan	9S	Slight	Moderate	Moderate	Slight	Eastern white pine	62	127	Red pine, eastern white pine.
						Quaking aspen	---	---	
						White oak	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
Coloma	2R	Moderate	Moderate	Moderate	Slight	Northern pin oak	49	33	Red pine, eastern white pine, eastern white pine, jack pine.
						Eastern white pine	---	---	
						Red maple	---	---	
130E**:									
Grattan	9R	Moderate	Moderate	Moderate	Slight	Eastern white pine	62	127	Red pine, eastern white pine.
						Quaking aspen	---	---	
						White oak	---	---	
						Black oak	---	---	
						Northern red oak	---	---	
						Red maple	---	---	
Coloma	2R	Moderate	Moderate	Moderate	Slight	Northern pin oak	49	33	Red pine, eastern white pine.
						Eastern white pine	---	---	
						Red maple	---	---	
						White oak	---	---	
131B**:									
Grattan	4S	Slight	Moderate	Moderate	Slight	White oak	65	59	Red pine, eatern white pine.
						Northern red oak	72	69	
						Red maple	62	39	
						Eastern white pine	62	127	
						Quaking aspen	---	---	
Coloma	2S	Slight	Moderate	Moderate	Slight	Northern pin oak	49	33	Red pine, eastern white pine, eastern white pine, jack pine.
						Eastern white pine	---	---	
						Red maple	---	---	
						Red pine	---	---	
131C**:									
Grattan	4S	Slight	Moderate	Moderate	Slight	White oak	65	59	Red pine, eastern white pine.
						Northern red oak	72	69	
						Red maple	62	39	
						Eastern white pine	62	127	
						Quaking aspen	---	---	
Coloma	2S	Slight	Moderate	Moderate	Slight	Northern pin oak	49	33	Red pine, eastern white pine, eastern white pine, jack pine.
						Eastern white pine	---	---	
						Red maple	---	---	
						Red pine	---	---	
131E**:									
Grattan	4R	Moderate	Moderate	Moderate	Slight	White oak	65	59	Red pine, eastern white pine.
						Northern red oak	72	69	
						Red maple	62	39	
						Eastern white pine	62	127	
						Quaking aspen	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Volume*	Trees to plant
131E**:									
Coloma	2R	Moderate	Moderate	Moderate	Slight	Northern pin oak	49	33	Red pine, eastern white pine.
						Eastern white pine	---	---	
						Red maple	---	---	
						Red pine	---	---	
135B**, 135C**:									
Grattan	4S	Slight	Moderate	Moderate	Slight	White oak	65	59	Red pine, eastern white pine, northern red oak.
						Northern red oak	72	69	
						Red maple	62	39	
						Eastern white pine	62	127	
						Quaking aspen	---	---	
Metea	4A	Slight	Slight	Slight	Slight	White oak	80	80	Eastern white pine, red pine, northern red oak.
						Eastern white pine	75	166	
						Red pine	75	142	
						Red maple	---	---	
						Northern red oak	---	---	
135E**:									
Grattan	4R	Moderate	Moderate	Moderate	Slight	White oak	65	59	Red pine, eastern white pine, northern red oak.
						Northern red oak	77	76	
						Red maple	72	47	
						Eastern white pine	62	127	
						Quaking aspen	---	---	
Metea	4R	Moderate	Moderate	Slight	Slight	White oak	80	80	Eastern white pine, red pine, northern red oak.
						Eastern white pine	75	166	
						Red pine	75	142	
						Red maple	---	---	
						Northern red oak	---	---	
135F**:									
Grattan	4R	Severe	Severe	Moderate	Slight	White oak	65	59	Red pine, eastern white pine, northern red oak.
						Northern red oak	77	76	
						Red maple	74	45	
						Eastern white pine	62	127	
						Quaking aspen	---	---	
Metea	4R	Severe	Severe	Slight	Slight	White oak	80	80	Eastern white pine, red pine, northern red oak.
						Eastern white pine	75	166	
						Red pine	75	142	
						Red maple	---	---	
						Northern red oak	---	---	
137B**, 137C**:									
Metea	4A	Slight	Slight	Slight	Slight	White oak	80	80	Eastern white pine, red pine, northern red oak.
						Eastern white pine	75	166	
						Red pine	75	142	
						Red maple	69	42	
						Northern red oak	85	88	
Tustin	3A	Slight	Slight	Slight	Slight	Black oak	55	38	Red pine, eastern white pine, Norway spruce.
						Red pine	---	---	
						Eastern white pine	---	---	
						Northern red oak	---	---	
						White oak	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
147C**:									
Marlette	3A	Slight	Slight	Slight	Slight	Sugar maple	65	40	Black walnut, eastern white pine, red pine, white spruce.
						Northern red oak	86	89	
						White ash	85	88	
						American basswood	---	---	
						Black cherry	---	---	
						American beech	---	---	
						Eastern hophornbeam	---	---	
Metea	4A	Slight	Slight	Slight	Slight	White oak	80	80	Eastern white pine, red pine, yellow poplar, black walnut.
						Sugar maple	76	47	
						Northern red oak	86	89	

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND

(Only the soils suitable for production of commercial trees are listed. Some terms that describe restrictive features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." an entry indicates that the soil was not rated)

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operat	
	Logging areas and skid trails	Landings	Logging roads		Logging areas and skid trails	Landings
2----------------- Glendora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter---------	Slight---------	Slight-------
3----------------- Adrian	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter---------	Moderate: low strength.	Severe: low strength
4A---------------- Cosad	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight---------	Slight-------
5B---------------- Pipestone	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight---------	Slight-------
8----------------- Cohoctah	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter---------	Slight---------	Slight-------
10B--------------- Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight-------
10B3-------------- Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Slight-------
10C--------------- Sparta	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight---------	Moderate: slope.
11---------------- Martisco	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter---------	Moderate: low strength.	Severe: low strength
13B*:						
Selfridge--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight---------	Slight-------
Capac------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight---------	Slight-------
14B--------------- Dixboro	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight---------	Slight-------
15B--------------- Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight---------	Slight-------

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operat	
	Logging areas and skid trails	Landings	Logging roads		Logging areas and skid trails	Landings
16--------------- Napoleon	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe wetness, low strength.	Winter----------	Moderate: low strength.	Severe: low strength
17B*:						
Spinks----------	Slight----------	Slight---------	Slight---------	Year round-----	Slight----------	Slight-------
Metea-----------	Slight----------	Slight---------	Slight---------	Year round-----	Slight----------	Slight-------
Coloma----------	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall. winter.	Slight----------	Slight-------
17C*:						
Spinks----------	Slight----------	Moderate: slope.	Slight---------	Year round-----	Slight----------	Moderate: slope.
Metea-----------	Slight----------	Moderate: slope.	Slight---------	Year round-----	Slight----------	Moderate: slope.
Coloma----------	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight----------	Moderate: slope.
17D*:						
Spinks----------	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round-----	Moderate: slope.	Severe: slope.
Metea-----------	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round-----	Moderate: slope.	Severe: slope.
19B-------------- Covert	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight----------	Slight-------
20--------------- Granby	Severe: wetness.	Severe: wetness.	Severe: wetness	Winter----------	Slight----------	Slight-------
21--------------- Kingsville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter----------	Slight----------	Slight-------
22B-------------- Scalley	Slight----------	Slight---------	Slight---------	Year round-----	Slight----------	Slight-------
22C-------------- Scalley	Slight----------	Moderate: slope.	Slight---------	Year round-----	Slight----------	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operat	
	Logging areas and skid trails	Landings	Logging roads		Logging areas and skid trails	Landings
22D: Scalley	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
23: Lamson	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter	Slight	Slight
24: Edwards	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength
27: Granby	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter	Slight	Slight
28: Watseka	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight	Slight
29B: Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Summer, fall, winter.	Slight	Slight
29C: Coloma	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
29D: Coloma	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
32: Carlisle	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength
36B: Del Rey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, fall, winter.	Slight	Slight
39B: Boyer	Slight	Slight	Slight	Year round	Slight	Slight
39C: Boyer	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
39D: Boyer	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
39E: Boyer	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operat	
	Logging areas and skid trails	Landings	Logging roads		Logging areas and skid trails	Landings
40B Tusti	Slight	Slight	Slight	Year round	Slight	Slight
40C Tustin	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
41B Marlette	Slight	Slight	Slight	Year round	Slight	Slight
41C Marlette	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
41C2 Marlette	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
41D Marlette	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
42B*:						
Metea	Slight	Slight	Slight	Year round	Slight	Slight
Marlette	Slight	Slight	Slight	Year round	Slight	Slight
Spinks	Slight	Slight	Slight	Year round	Slight	Slight
42C*:						
Metea	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
Marlette	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
Spinks	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
42C2*:						
Metea	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
Marlette	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
Spinks	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid trails	Landings	Logging roads	Preferred operating season(s)	Ratings for preferred operat: Logging areas and skid trails	Landings
42D*:						
Metea	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
Spinks	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
Marlette	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
42E*:						
Metea	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
Spinks	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
43B Metea	Slight	Slight	Slight	Year round	Slight	Slight
43C Metea	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
44B Spinks	Slight	Slight	Slight	Year round	Slight	Slight
44C Spinks	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
44D Spinks	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
44E Spinks	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
46B Perrinton	Slight	Moderate: low strength.	Moderate: low strength.	Summer, winter.	Slight	Slight
46C Perrinton	Slight	Moderate: low strength, slope.	Moderate: low strength.	Summer, winter.	Slight	Moderate: slope.
46D Perrinton	Moderate: slope.	Severe: slope.	Moderate: low strength.	Summer, winter.	Moderate: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operat	
	Logging areas and skid trails	Landings	Logging roads		Logging areas and skid trails	Landings
46F: Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Summer, winter.	Severe: slope.	Severe: slope.
47B: Toogood	Slight	Slight	Slight	Year round	Slight	Slight
47C: Toogood	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
47D: Toogood	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
49B: Toogood	Slight	Slight	Slight	Year round	Slight	Slight
51B: Thetford	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Summer, fall, winter.	Slight	Slight
52: Linwood	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength
53: Parkhill	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight	Slight
55: Sickles	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight	Slight
60B: Grattan	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
60C: Grattan	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
60D: Grattan	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
62: Jebavy	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter	Slight	Slight
65: Wauseon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight	Slight

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid trails	Ratings for most limiting season(s): Landings	Ratings for most limiting season(s): Logging roads	Preferred operating season(s)	Ratings for preferred operat[ing season]: Logging areas and skid trails	Ratings for preferred operat[ing season]: Landings
82 Algansee	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight	Slight
88 Ceresco	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight	Slight
91B Plainfield	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
91C Plainfield	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
91D Plainfield	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
91F Plainfield	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.
92B Selfridge	Severe: wetness.	Severe: wetness.	Severe: wetness.	Summer, winter.	Slight	Slight
94B Brems	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
95A Abscota	Slight	Moderate: flooding.	Moderate: flooding.	Summer, winter	Slight	Slight
96A*:						
Pipestone	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter	Slight	Slight
Kingsville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Winter	Slight	Slight
98F*:						
Plainfield	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.
Perrinton	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Year round	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid trails	Landings	Logging roads	Preferred operating season(s)	Ratings for preferred operat: Logging areas and skid trails	Landings
111B: Plainfield	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
111C: Plainfield	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
112B: Plainfield	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
115B*:						
Plainfield, banded substratum	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
Plainfield, loamy substratum	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
121B: Grattan	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
121C: Grattan	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
122B: Grattan	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
125B*:						
Grattan	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
Spinks	Slight	slight	Slight	Year round	Slight	Slight
125C*:						
Grattan	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
Spinks	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operat	
	Logging areas and skid trails	Landings	Logging roads		Logging areas and skid trails	Landings
125E*:						
Grattan	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
Spinks	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
130B*:						
Grattan	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
130C*:						
Grattan	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
Coloma	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
130E*:						
Grattan	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
Coloma	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
131B*:						
Grattan	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
Coloma	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
131C*:						
Grattan	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s)			Preferred operating season(s)	Ratings for preferred operat	
	Logging areas and skid trails	Landings	Logging roads		Logging areas and skid trails	Landings
131C*:						
Coloma	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.	Spring, fall, winter.	Slight	Moderate: slope.
131E*:						
Grattan	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
Coloma	Moderate: too sandy, slope.	Severe: slope.	Moderate: too sandy, slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
135B*:						
Grattan	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Spring, fall, winter.	Slight	Slight
Metea	Slight	Slight	Slight	Year round	Slight	Slight
135C*:						
Grattan	Moderate: slope.	Severe: slope.	Moderate: slope.	Spring, fall, winter.	Slight	Moderate: slope.
Metea	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
135E*:						
Grattan	Moderate: slope.	Severe: slope.	Moderate: slope.	Spring, fall, winter.	Moderate: slope.	Severe: slope.
Metea	Moderate: slope.	Severe: slope.	Moderate: slope.	Year round	Moderate: slope.	Severe: slope.
135F*:						
Grattan	Severe: slope.	Severe: slope.	Severe: slope.	Spring, fall, winter.	Severe: slope.	Severe: slope.
Metea	Severe: slope.	Severe: slope.	Severe: slope.	Year round	Severe: slope.	Severe: slope.
137B*:						
Metea	Slight	Slight	Slight	Year round	Slight	Slight

See footnote at end of table.

TABLE 9.--EQUIPMENT LIMITATIONS ON WOODLAND--Continued

Soil name and map symbol	Ratings for most limiting season(s): Logging areas and skid trails	Ratings for most limiting season(s): Landings	Ratings for most limiting season(s): Logging roads	Preferred operating season(s)	Ratings for preferred operat: Logging areas and skid trails	Ratings for preferred operat: Landings
137B*:						
Tustin	Slight	Slight	Slight	Year round	Slight	Slight
137C*:						
Metea	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
Tustin	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
147C*:						
Marlette	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
Metea	Slight	Moderate: slope.	Slight	Year round	Slight	Moderate: slope.
181 Histosols	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength
182 Histosols	Severe: wetness, low strength.	Severe: wetness, low strength.	Severe: wetness, low strength.	Winter	Moderate: low strength.	Severe: low strength

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
2. Glendora				
3----------------- Adrian	Indigo silky dogwood, common ninebark, Amur privet, American cranberrybush, late lilac, Siberian peashrub, nannyberry viburnum.	Northern whitecedar, Siberian crabapple.	Eastern white pine, green ash.	Imperial Carolina poplar.
4A---------------- Cosad	American cranberrybush, indigo silky dogwood, lilac, nannyberry, viburnum.	Northern whitecedar, Siberian crabapple, blue spruce.	Green ash, Norway spruce, eastern white pine.	Imperial Carolina poplar.
5B---------------- Pipestone	Lilac, silky dogwood, American cranberrybush.	Northern whitecedar, Amur maple, white spruce.	Red maple, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
8----------------- Cohoctah	European privet, American cranberrybush, lilac, nannyberry viburnum.	Northern whitecedar, Manchurian crabapple, white spruce.	Green ash, Norway spruce, eastern white pine.	Imperial Carolina poplar.
10B, 10B3, 10C---- Sparta	Siberian peashrub, Amur maple, lilac, eastern redcedar, American cranberrybush, gray dogwood, indigo silky dogwood.	Norway spruce---------	Red pine, eastern white pine, jack pine.	---
11---------------- Martisco	Common ninebark, nannyberry viburnum, silky dogwood, Amur privet, late lilac.	Northern whitecedar---	Siberian crabapple, eastern white pine, green ash, black willow, red maple.	Imperial Carolina poplar.
13B*:				
Selfridge--------	Silky dogwood, lilac, Amur maple, American cranberrybush, nannyberry viburnum.	Northern whitecedar, Siberian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	---
Capac------------	American cranberrybush, lilac.	White spruce, northern whitecedar, Amur maple.	Eastern white pine, red maple, Norway spruce, green ash.	Imperial Carolina poplar.
14B--------------- Dixboro	Nannyberry viburnum, American cranberrybush, gray dogwood.	White spruce, northern whitecedar.	Eastern white pine, Norway spruce, green ash, Norway spruce.	Imperial Carolina poplar.
15B--------------- Capac	American cranberrybush, lilac.	White spruce, northern whitecedar, Amur maple.	Eastern white pine, red maple, Norway spruce, green ash.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
16. Napoleon				
17B*, 17C*:				
Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Coloma	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
17D*:				
Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
19B Covert	Lilac, eastern redcedar, Tatarian honeysuckle, Siberian peashrub.	Austrian pine, jack pine, red pine.	Eastern white pine	---
20 Granby	American cranberrybush, lilac, nannyberry viburnum.	Northern whitecedar, white spruce, Manchurian crabapple, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
21. Kingsville				
22B, 22C, 22D Scalley	Lilac, Roselow sargent crabapple, silky dogwood, Amur honeysuckle, eastern redcedar, Siberian peashrub.	Austrian pine, Siberian crabapple, jack pine.	Eastern white pine, red pine, green ash.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
23 Lamson	American cranberrybush, Tatarian honeysuckle, Amur privet, silky dogwood.	Northern whitecedar, white spruce.	Eastern white pine, green ash.	---
24 Edwards	Amur privet, nannyberry viburnum, American cranberrybush, silky dogwood, common ninebark, lilac, Amur maple.	White spruce, Siberian crabapple, northern whitecedar.	Green ash	Imperial Carolina poplar.
27 Granby	American cranberrybush, lilac, nannyberry viburnum.	Northern whitecedar, Manchurian crabapple, green ash.	Eastern white pine, Norway spruce.	Imperial Carolina poplar.
28B Watseka	Redosier dogwood, lilac.	White spruce, northern whitecedar, blue spruce, Amur maple.	Eastern white pine, Austrian pine, hackberry, green ash.	Silver maple.
29B, 29C, 29D Coloma	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
32 Carlisle	Common ninebark, Amur privet, American cranberrybush, silky dogwood, nannyberry viburnum.	Northern whitecedar, white spruce, Siberian crabapple.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
36B Del Rey	American cranberrybush, Amur privet, late lilac.	Eastern white pine, white spruce.	White ash, red pine, red maple, Norway spruce, Black Hills spruce.	Green ash.
39B, 39C, 39D, 39E Boyer	Amur maple, Siberian peashrub, lilac, Roselow sargent crabapple, Manchurian crabapple.	Red pine, Austrian pine, green ash, eastern redcedar.	Eastern white pine	---
40B, 40C Tustin	Siberian peashrub, lilac, eastern redcedar, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
41B Marlette	American cranberrybush, lilac, nannyberry viburnum.	White spruce, northern whitecedar, Amur maple, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
41C------------- Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
41C2------------- Marlette	American cranberrybush, lilac, nannyberry viburnum.	White spruce, northern whitecedar, Amur maple, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
41D------------- Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
42B*:				
Metea------------	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce---------	Eastern white pine, red pine, jack pine.	---
Marlette---------	American cranberrybush, lilac, nannyberry viburnum.	White spruce, northern whitecedar, Amur maple, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Spinks-----------	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
42C*:				
Metea------------	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce---------	Eastern white pine, red pine, jack pine.	---
Marlette---------	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Spinks-----------	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
42C2*:				
Metea------------	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce---------	Eastern white pine, red pine, jack pine.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
42C2*:				
Marlette	American cranberrybush, lilac, nannyberry viburnum.	White spruce, northern whitecedar, Amur maple, Manchurian crabapple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
42D*:				
Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
42E*:				
Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
43B, 43C Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
44B, 44C, 44D, 44E Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
46B, 46C, 46D, 46F. Perrinton	Roselow sargent crabapple, lilac, northern whitecedar, American cranberrybush, nannyberry viburnum.	White spruce, Amur maple, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	---
47B, 47C, 47D, 49B. Toogood	Eastern redcedar, Siberian peashrub, Peking cotoneaster, lilac.	Jack pine, Austrian pine, red pine, honeylocust, black locust.	Eastern white pine	---
51B. Thetford	Silky dogwood, lilac, American cranberrybush.	White spruce, northern whitecedar, Amur maple.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
52. Linwood	Common ninebark, lilac, silky dogwood, American cranberrybush, gray dogwood.	Northern whitecedar, white spruce, Siberian crabapple.	Norway spruce, green ash, eastern white pine.	Imperial Carolina poplar.
53. Parkhill	Common ninebark, lilac, nannyberry viburnum, American cranberrybush.	Northern whitecedar, white spruce, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	---
55. Sickles	Silky dogwood, nannyberry viburnum, American cranberrybush, Siberian peashrub, lilac.	Northern whitecedar, white spruce, Amur maple, Siberian crabapple.	Eastern white pine, green ash, Norway spruce.	---
60B, 60C, 60D. Grattan	Lilac, eastern redcedar, Siberian peashrub, Tatarian honeysuckle.	Siberian crabapple, Austrian pine, jack pine.	Red pine, eastern white pine.	---
62. Jebavy				
65. Wauseon	American cranberrybush, silky dogwood, Amur privet, common ninebark, nannyberry viburnum.	Manchurian crabapple, northern whitecedar.	Eastern white pine, green ash, Norway spruce.	Imperial Carolina poplar.
70. Udorthents				
72. Udipsamments				
82. Algansee	Silky dogwood, lilac, American cranberrybush.	Northern whitecedar, Manchurian crabapple, Amur maple, white spruce.	Green ash, eastern white pine, Norway spruce, red maple.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
88 Ceresco	Common ninebark, silky dogwood, American cranberrybush.	White spruce, northern whitecedar, Manchurian crabapple, Amur maple.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
90*: Histosols.				
Aquents.				
91B, 91C, 91D, 91F Plainfield	Siberian peashrub, lilac, eastern redcedar, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
92B Selfridge	Silky dogwood, lilac, Amur maple, American cranberrybush, nannyberry viburnum.	Northern whitecedar, Siberian crabapple, white spruce.	Eastern white pine, Norway spruce, green ash, red maple.	---
93*. Pits				
94B Brems	Eastern redcedar, Amur maple, Siberian peashrub, gray dogwood.	Red pine, Norway spruce, lilac.	Eastern white pine, jack pine, Siberian crabapple, green ash.	---
95A Abscota	Silky dogwood, Amur privet, nannyberry viburnum, American cranberrybush, common ninebark.	White spruce, northern whitecedar, Manchurian crabapple.	Eastern white pine, Norway spruce, green ash.	Imperial Carolina poplar.
96A*: Pipestone	Lilac, silky dogwood, American cranberrybush.	Northern whitecedar, Amur maple, white spruce.	Red maple, Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.
Kingsville.				
97B*: Urban land.				
Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
98F*:				
Plainfield	Siberian peashrub, lilac, eastern redcedar, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Perrinton	Roselow sargent crabapple, lilac, northern whitecedar, American cranberrybush, nannyberry viburnum.	White spruce, Amur maple, Manchurian crabapple.	Eastern white pine, green ash, Norway spruce.	---
111B, 111C, 112B-- Plainfield	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
115B*:				
Plainfield, banded substratum	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Plainfield, loamy substratum	Eastern redcedar, lilac, Amur maple, American cranberrybush, Siberian peashrub, silky dogwood, gray dogwood.	Norway spruce	Eastern white pine, red pine, jack pine.	---
121B, 121C, 122B-- Grattan	Lilac, eastern redcedar, Siberian peashrub, Tatarian honeysuckle.	Siberian crabapple, Austrian pine, jack pine.	Red pine, eastern white pine.	---
125B*, 125C*, 125E*:				
Grattan	Lilac, eastern redcedar, Siberian peashrub, Tatarian honeysuckle.	Siberian crabapple, Austrian pine, jack pine.	Red pine, eastern white pine.	---

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
125B*, 125C*, 125E*: Spinks	American cranberrybush, silky dogwood, lilac, Siberian peashrub, Tatarian honeysuckle.	White spruce, eastern redcedar.	Eastern white pine, red pine, green ash, Norway spruce.	Imperial Carolina poplar.
130B*, 130C*, 130E*, 131B*, 131C*, 131E*: Grattan	Lilac, eastern redcedar, Siberian peashrub, Tatarian honeysuckle.	Siberian crabapple, Austrian pine, jack pine.	Red pine, eastern white pine.	---
Coloma	Eastern redcedar, Siberian peashrub, lilac, American cranberrybush, silky dogwood, gray dogwood, Amur maple.	Norway spruce	Eastern white pine, red pine, jack pine.	---
135B*, 135C*, 135E*, 135F*: Grattan	Lilac, eastern redcedar, Siberian peashrub, Tatarian honeysuckle.	Siberian crabapple, Austrian pine, jack pine.	Red pine, eastern white pine.	---
Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
137B*, 137C*: Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
Tustin	Siberian peashrub, lilac, eastern redcedar, silky dogwood, Amur maple, gray dogwood, American cranberrybush.	Norway spruce	Eastern white pine, red pine, jack pine.	---
147C*: Marlette	American cranberrybush, common ninebark, lilac, silky dogwood.	White spruce, Amur maple, Manchurian crabapple, nannyberry viburnum.	Norway spruce, eastern white pine, green ash.	Imperial Carolina poplar.

See footnote at end of table.

TABLE 10.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
147C*:				
Metea	Amur maple, silky dogwood, American cranberrybush, Siberian peashrub, gray dogwood, lilac, eastern redcedar.	Norway spruce	Eastern white pine, red pine, jack pine.	---
181, 182. Histosols				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
2 Glendora	Severe: flooding, wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness, flooding.	Severe: wetness, too sandy.
3 Adrian	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
4A Cosad	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.
5B Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
8 Cohoctah	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
10B, 10B3 Sparta	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
10C Sparta	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
11 Martisco	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
13B*:				
Selfridge	Severe: wetness.	Moderate: wetness, too sandy, percs slowly.	Severe: wetness.	Moderate: wetness, too sandy.
Capac	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
14B Dixboro	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
15B Capac	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
16 Napoleon	Severe: ponding, excess humus, too acid.	Severe: ponding, excess humus, too acid.	Severe: excess humus, ponding, too acid.	Severe: ponding, excess humus.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
17B*:				
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Metea	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
17C*:				
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Metea	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
17D*:				
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.
Metea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
19B Covert	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
20 Granby	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
21 Kingsville	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
22B Scalley	Slight	Slight	Moderate: slope, small stones.	Slight.
22C Scalley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
22D Scalley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
23 Lamson	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
24 Edwards	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
27 Granby	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
28B Watseka	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
29B Coloma	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
29C Coloma	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
29D Coloma	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
32 Carlisle	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
36B Del Rey	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.
39B Boyer	Slight	Slight	Moderate: slope, small stones.	Slight.
39C Boyer	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
39D Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
39E Boyer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
40B Tustin	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
40C Tustin	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
41B Marlette	Slight	Slight	Moderate: slope, small stones.	Slight.
41C, 41C2 Marlette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
41D Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
42B*:				
Metea	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
Marlette	Slight	Slight	Moderate: slope, small stones.	Slight.
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
42C*, 42C2*:				
Metea	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
Marlette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
42D*:				
Metea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
42E*:				
Metea	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
43B Metea	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
43C Metea	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
44B Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
44C Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
44D Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.
44E Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
46B Perrinton	Slight	Slight	Moderate: slope, small stones.	Severe: erodes easily.
46C Perrinton	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
46D Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
46F Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
47B Toogood	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
47C Toogood	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
47D Toogood	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
49B Toogood	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: slope, small stones, too sandy.	Moderate: too sandy.
51B Thetford	Severe: wetness.	Moderate: wetness, too sandy.	Severe: wetness.	Moderate: wetness, too sandy.
52 Linwood	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
53 Parkhill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
55 Sickles	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
60B Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
60C Grattan	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
60D Grattan	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
62 Jebavy	Severe: ponding, too sandy, cemented pan.	Severe: ponding, too sandy, cemented pan.	Severe: too sandy, ponding, cemented pan.	Severe: ponding, too sandy.
65 Wauseon	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
70 Udorthents	Variable	Variable	Variable	Variable.
72 Udipsamments	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
82 Algansee	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
88 Ceresco	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
90*:				
Histosols	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.
Aquents	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
91B Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
91C Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
91D, 91F Plainfield	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
92B Selfridge	Severe: wetness.	Moderate: wetness, too sandy, percs slowly.	Severe: wetness.	Moderate: wetness, too sandy.
93*. Pits				
94B Brems	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
95A Abscota	Severe: flooding.	Slight	Moderate: flooding.	Slight.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
96A*:				
Pipestone	Severe: wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness.	Severe: wetness, too sandy.
Kingsville	Severe: ponding, too sandy.	Severe: ponding, too sandy.	Severe: too sandy, ponding.	Severe: ponding, too sandy.
97B*: Urban land.				
Metea	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
Marlette	Slight	Slight	Moderate: slope, small stones.	Slight.
98F*:				
Plainfield	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
111B Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
111C Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
112B Plainfield	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
115B*:				
Plainfield, banded substratum	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Plainfield, loamy substratum	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
121B Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
121C Grattan	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
122B Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
125B*:				
Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
125B*:				
Spinks	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
125C*:				
Grattan	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Spinks	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
125E*:				
Grattan	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Spinks	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, too sandy.
130B*:				
Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
130C*:				
Grattan	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
130E*:				
Grattan	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Coloma	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
131B*:				
Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
131C*:				
Grattan	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
131C*:				
Coloma	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
131E*:				
Grattan	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Coloma	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
135B*:				
Grattan	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Metea	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
135C*:				
Grattan	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Metea	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
135E*:				
Grattan	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Metea	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
135F*:				
Grattan	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
Metea	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
137B*:				
Metea	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
Tustin	Moderate: percs slowly, too sandy.	Moderate: too sandy, percs slowly.	Moderate: slope, too sandy.	Moderate: too sandy.
137C*:				
Metea	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
137C*:				
Tustin	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
147C*:				
Marlette	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Metea	Moderate: slope, percs slowly.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.
181, 182 Histosols	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
2: Glendora	Very poor	Very poor	Fair	Fair	Fair	Good	Good	Very poor	Fair	Good.
3: Adrian	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
4A: Cosad	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
5B: Pipestone	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
8: Cohoctah	Poor	Poor	Poor	Good	Good	Good	Good	Poor	Good	Good.
10B, 10B3: Sparta	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
10C: Sparta	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
11: Martisco	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
13B*:										
Selfridge	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
Capac	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
14B: Dixboro	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
15B: Capac	Good	Good	Good	Good	Fair	Poor	Poor	Good	Good	Poor.
16: Napoleon	Very poor.	Very poor.	Poor	Poor	Poor	Good	Good	Very poor.	Poor	Good.
17B*:										
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
17C*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Metea	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
17C*:										
Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
17D*:										
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Metea	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
19B Covert	Poor	Poor	Fair	Good	Good	Poor	Poor	Poor	Good	Poor.
20 Granby	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
21 Kingsville	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
22B Scalley	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
22C, 22D Scalley	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
23 Lamson	Very poor.	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
24 Edwards	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
27 Granby	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Good.
28B Watseka	Fair	Fair	Good	Good	Good	Fair	Poor	Fair	Good	Poor.
29B Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
29C Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
29D Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
32 Carlisle	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
36B Del Rey	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
39B, 39C, 39D Boyer	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
39E Boyer	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
40B, 40C----------- Tustin	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
41B---------------- Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
41C, 41C2---------- Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
41D---------------- Marlette	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
42B*:										
Metea-------------	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Marlette----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Spinks------------	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
42C*, 42C2*:										
Metea-------------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Marlette----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Spinks------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
42D*:										
Metea-------------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Spinks------------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Marlette----------	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
42E*:										
Metea-------------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Spinks------------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
43B---------------- Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
43C---------------- Metea	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
44B---------------- Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
44C, 44D----------- Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
44E----------------- Spinks	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
46B----------------- Perrinton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
46C----------------- Perrinton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
46D----------------- Perrinton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
46F----------------- Perrinton	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
47B----------------- Toogood	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
47C, 47D----------- Toogood	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
49B----------------- Toogood	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor.
51B----------------- Thetford	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
52------------------ Linwood	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
53------------------ Parkhill	Poor	Fair	Fair	Good	Good	Good	Good	Fair	Good	Good.
55------------------ Sickles	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
60B----------------- Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
60C, 60D----------- Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
62------------------ Jebavy	Poor	Poor	Fair	Fair	Fair	Good	Good	Poor	Fair	Poor.
65------------------ Wauseon	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
70. Udorthents										
72. Udipsamments										
82------------------ Algansee	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
88------------------ Ceresco	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Hardwood trees	Conif-erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
90*:										
Histosols	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Aquents	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
91B Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
91C, 91D, 91F Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
92B Selfridge	Fair	Fair	Good	Good	Good	Poor	Poor	Fair	Good	Poor.
93*. Pits										
94B Brems	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Poor.
95A Abscota	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
96A*:										
Pipestone	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
Kingsville	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
97B*: Urban land.										
Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Marlette	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
98F*:										
Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Perrinton	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
111B Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
111C Plainfield	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
112B Plainfield	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
115B*: Plainfield, banded substratum	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
115B*:										
Plainfield, loamy substratum	Fair	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
121B Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
121C Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
122B Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
125B*:										
Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Spinks	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
125C*, 125E*:										
Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Spinks	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
130B*:										
Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
130C*:										
Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
130E*:										
Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
131B*:										
Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Coloma	Fair	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
131C*:										
Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
131C*:										
Coloma	Poor	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Coloma	Very poor.	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.
135B*:										
Grattan	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
135C*:										
Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Metea	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
135E*, 135F*:										
Grattan	Very poor.	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Metea	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
137B*:										
Metea	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Tustin	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
137C*:										
Metea	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Tustin	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
147C*:										
Marlette	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Metea	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
181, 182 Histosols	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
2 Glendora	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
3 Adrian	Severe: cutbanks cave, excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
4A Cosad	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
5B Pipestone	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
8 Cohoctah	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness, flooding.
10B, 10B3 Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
10C Sparta	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
11 Martisco	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding, excess humus.
13B*:						
Selfridge	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
14B Dixboro	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
15B Capac	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
16 Napoleon	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: too acid, ponding, excess humus.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
17B*:						
Spinks-----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
Metea------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
Coloma-----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
17C*:						
Spinks-----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Metea------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Coloma-----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
17D*:						
Spinks-----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Metea------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
19B--------------- Covert	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
20---------------- Granby	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
21---------------- Kingsville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
22B--------------- Scalley	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
22C--------------- Scalley	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
22D--------------- Scalley	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
23---------------- Lamson	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
24---------------- Edwards	Severe: ponding, excess humus.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: excess humus, ponding.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
27 Granby	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
28B Watseka	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
29B Coloma	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
29C Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
29D Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
32 Carlisle	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
36B Del Rey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
39B Boyer	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
39C Boyer	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
39D, 39E Boyer	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
40B Tustin	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Moderate: frost action.	Moderate: droughty.
40C Tustin	Severe: cutbanks cave.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
41B Marlette	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Severe: low strength.	Slight.
41C, 41C2 Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
41D Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
42B*:						
Metea	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
Marlette	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
42B*:						
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
42C*, 42C2*:						
Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
42D*:						
Metea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Marlette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
42E*:						
Metea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
43B Metea	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
43C Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
44B Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
44C Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
44D, 44E Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
46B Perrinton	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
46C---------------- Perrinton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
46D, 46F---------- Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
47B---------------- Toogood	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
47C---------------- Toogood	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
47D---------------- Toogood	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
49B---------------- Toogood	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
51B---------------- Thetford	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: wetness, droughty.
52----------------- Linwood	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
53----------------- Parkhill	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
55----------------- Sickles	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
60B---------------- Grattan	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
60C---------------- Grattan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
60D---------------- Grattan	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
62----------------- Jebavy	Severe: cemented pan, cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, cemented pan.	Severe: ponding.	Severe: ponding.	Severe: ponding, cemented pan, droughty.
65----------------- Wauseon	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.

See footnote at end of table.

TABLE 13 --BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
70 Udorthents	Variable	Variable	Variable	Variable	Variable	Variable.
72 Udipsamments	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
82 Algansee	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: flooding, droughty, wetness.
88 Ceresco	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
90*:						
Histosols	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.
Aquents	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
91B Plainfield	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
91C Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
91D, 91F Plainfield	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
92B Selfridge	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness, droughty.
93* Pits						
94B Brems	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty, too sandy.
95A Abscota	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.
96A*:						
Pipestone	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Kingsville	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
97B*: Urban land.						

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
97B*:						
Metea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Marlette	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
98F*:						
Plainfield	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Perrinton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
111B Plainfield	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
111C Plainfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
112B Plainfield	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
115B*:						
Plainfield, banded substratum	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Plainfield, loamy substratum	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
121B Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
121C Grattan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
122B Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
125B*:						
Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Spinks	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
125C*:						
Grattan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Spinks	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
125E*:						
Grattan	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Spinks	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
130B*:						
Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty, too sandy.
Coloma	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
130C*:						
Grattan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
130E*:						
Grattan	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
131B*:						
Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
Coloma	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.
131C*:						
Grattan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Coloma	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
131E*:						
Grattan	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Coloma	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
135B*:						
Grattan	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: droughty.

See footnote at end of table.

TABLE 13.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
135B*:						
Metea	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
135C*:						
Grattan	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: droughty.
Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
135E*, 135F*:						
Grattan	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
Metea	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
137B*:						
Metea	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
Tustin	Severe: cutbanks cave.	Slight	Severe: shrink-swell.	Slight	Moderate: frost action.	Moderate: droughty.
137C*:						
Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Tustin	Severe: cutbanks cave.	Moderate: slope.	Severe: shrink-swell.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
147C*:						
Marlette	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
181, 182 Histosols	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding.	Severe: ponding, low strength.	Severe: ponding, frost action.	Severe: ponding, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2-------------------- Glendora	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
3-------------------- Adrian	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
4A------------------- Cosad	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: seepage, too clayey, wetness.
5B------------------- Pipestone	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
8-------------------- Cohoctah	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
10B, 10B3------------ Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
10C------------------ Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
11------------------- Martisco	Severe: ponding, percs slowly.	Severe: seepage, excess humus.	Severe: ponding.	Severe: ponding.	Poor: ponding.
13B*:					
Selfridge------------	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
Capac----------------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
14B------------------ Dixboro	Severe: wetness.	Severe: wetness.	Severe: wetness, too sandy.	Severe: wetness.	Poor: too sandy, wetness.
15B------------------ Capac	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
16------------------ Napoleon	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus, too acid.
17B*:					
Spinks-------------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Metea--------------	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Coloma-------------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17C*:					
Spinks-------------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Metea--------------	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Coloma-------------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
17D*:					
Spinks-------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Metea--------------	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
19B----------------- Covert	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
20------------------ Granby	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
21------------------ Kingsville	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
22B----------------- Scalley	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
22C: Scalley	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
22D: Scalley	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
23: Lamson	Severe: ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Severe: seepage, ponding.	Poor: ponding, thin layer.
24: Edwards	Severe: subsides, ponding, percs slowly.	Severe: ponding, seepage, excess humus.	Severe: seepage, ponding.	Severe: ponding, seepage.	Poor: ponding, excess lime.
27: Granby	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
28B: Watseka	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
29B: Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
29C: Coloma	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
29D: Coloma	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
32: Carlisle	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: seepage, ponding, excess humus.	Severe: seepage, ponding.	Poor: ponding, excess humus.
36B: Del Rey	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
39B: Boyer	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
39C: Boyer	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
39D, 39E------------ Boyer	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
40B----------------- Tustin	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
40C----------------- Tustin	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
41B----------------- Marlette	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
41C, 41C2----------- Marlette	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
41D----------------- Marlette	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
42B*:					
Metea--------------	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Marlette-----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Spinks-------------	Slight-----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
42C*, 42C2*:					
Metea--------------	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Marlette-----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Spinks-------------	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
42D*:					
Metea--------------	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Spinks-------------	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
42D*:					
Marlette	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
42E*:					
Metea	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
43B Metea	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
43C Metea	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
44B Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
44C Spinks	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
44D, 44E Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
46B Perrinton	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
46C Perrinton	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
46D, 46F Perrinton	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
47B Toogood	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
47C Toogood	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
47D----------------- Toogood	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
49B----------------- Toogood	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
51B----------------- Thetford	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: too sandy, wetness.
52------------------ Linwood	Severe: ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
53------------------ Parkhill	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
55------------------ Sickles	Severe: ponding, percs slowly, poor filter.	Severe: seepage, ponding.	Severe: ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
60B----------------- Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
60C----------------- Grattan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
60D----------------- Grattan	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
62------------------ Jebavy	Severe: cemented pan, ponding, percs slowly.	Severe: seepage, cemented pan, ponding.	Severe: seepage, ponding, too sandy.	Severe: cemented pan, seepage, ponding.	Poor: cemented pan, seepage, too sandy.
65------------------ Wauseon	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding, too clayey.	Severe: seepage, ponding.	Poor: too clayey, hard to pack, ponding.
70------------------ Udorthents	Variable---------	Variable---------	Variable---------	Variable---------	Variable.
72------------------ Udipsamments	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
82------------------ Algansee	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
88------------------ Ceresco	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness.
90*:					
Histosols----------	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.
Aquents------------	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
91B----------------- Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
91C----------------- Plainfield	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
91D, 91F------------ Plainfield	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
92B----------------- Selfridge	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: wetness.	Severe: seepage, wetness.	Poor: wetness.
93* Pits					
94B----------------- Brems	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
95A----------------- Abscota	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
96A*:					
Pipestone----------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Kingsville---------	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
97B*:					
Urban land.					
Metea	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Marlette	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
98F*:					
Plainfield	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Perrinton	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
111B Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
111C Plainfield	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
112B Plainfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
115B*:					
Plainfield, banded substratum	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Plainfield, loamy substratum	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
121B Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
121C Grattan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
122B Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
125B*:					
Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Spinks	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
125C*:					
Grattan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Spinks	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
125E*:					
Grattan	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Spinks	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
130B*:					
Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
130C*:					
Grattan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Coloma	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
130E*:					
Grattan	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Coloma	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
131B*:					
Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Coloma	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
131C*:					
Grattan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Coloma	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
131E*:					
Grattan	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Coloma	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
135B*:					
Grattan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Metea	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
135C*:					
Grattan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Metea	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
135E*, 135F*:					
Grattan	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Metea	Severe: percs slowly, poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.

See footnote at end of table.

TABLE 14.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
137B*:					
Metea--------------	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Tustin-------------	Severe: percs slowly, poor filter.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
137C*:					
Metea--------------	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Tustin-------------	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
147C*:					
Marlette-----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Metea--------------	Severe: percs slowly, poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
181, 182------------ Histosols	Severe: ponding.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding.	Poor: ponding, excess humus.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
2--------------------- Glendora	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: too sandy, wetness.
3--------------------- Adrian	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: excess humus, wetness.
4A-------------------- Cosad	Poor: low strength, wetness.	Probable-------------	Improbable: too sandy.	Poor: too sandy, wetness.
5B-------------------- Pipestone	Poor: wetness.	Probable-------------	Improbable: too sandy.	Poor: too sandy, wetness.
8--------------------- Cohoctah	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
10B, 10B3, 10C-------- Sparta	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
11-------------------- Martisco	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
13B*:				
Selfridge------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Capac----------------	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, area reclaim.
14B------------------- Dixboro	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
15B------------------- Capac	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, area reclaim.
16-------------------- Napoleon	Poor: wetness.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness, too acid.
17B*:				
Spinks---------------	Good-----------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
Metea----------------	Good-----------------	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
17B*:				
Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
17C*:				
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.
17D*:				
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Metea	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
19B Covert	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
20 Granby	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
21 Kingsville	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
22B, 22C Scalley	Good	Probable	Improbable: too sandy.	Poor: area reclaim.
22D Scalley	Fair: slope.	Probable	Improbable: too sandy.	Poor: area reclaim, slope.
23 Lamson	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
24 Edwards	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: wetness, excess humus.
27 Granby	Poor: wetness.	Probable	Probable	Poor: too sandy, wetness.
28B Watseka	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
29B, 29C Coloma	Good	Probable	Improbable: too sandy.	Poor: too sandy, small stones.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
29D: Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
32: Carlisle	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
36B: Del Rey	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
39B, 39C: Boyer	Good	Probable	Probable	Poor: small stones, area reclaim.
39D: Boyer	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
39E: Boyer	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
40B, 40C: Tustin	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
41B: Marlette	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
41C, 41C2: Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
41D: Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
42B*:				
Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Marlette	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
42C*, 42C2*:				
Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
42C*, 42C2*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
42D*:				
Metea	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Marlette	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
42E*:				
Metea	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
Spinks	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
43B, 43C Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
44B Spinks	Good	Probable	Improbable: too sandy.	Fair: too sandy.
44C Spinks	Good	Probable	Improbable: too sandy.	Fair: slope, too sandy.
44D Spinks	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
44E Spinks	Poor: slope.	Probable	Improbable: too sandy.	Poor: slope.
46B, 46C Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
46D Perrinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
46F Perrinton	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
47B, 47C Toogood	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
47D------------------- Toogood	Fair: slope.	Probable------------	Probable------------	Poor: too sandy, small stones, area reclaim.
49B------------------- Toogood	Fair: wetness.	Probable------------	Probable------------	Poor: too sandy, small stones, area reclaim.
51B------------------- Thetford	Fair: wetness.	Probable------------	Improbable: too sandy.	Poor: too sandy.
52-------------------- Linwood	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
53-------------------- Parkhill	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
55-------------------- Sickles	Poor: wetness.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, wetness.
60B, 60C-------------- Grattan	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
60D------------------- Grattan	Poor: slope.	Probable------------	Improbable: too sandy.	Poor: too sandy, slope.
62-------------------- Jebavy	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: cemented pan, area reclaim, too sandy.
65-------------------- Wauseon	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
70-------------------- Udorthents	Variable------------	Variable------------	Variable------------	Variable.
72-------------------- Udipsamments	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
82-------------------- Algansee	Fair: wetness.	Probable------------	Improbable: too sandy.	Poor: too sandy.
88-------------------- Ceresco	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
90*:				
Histosols-------------	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: excess humus.	Poor: excess humus, wetness.
Aquents---------------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
91B, 91C: Plainfield	Good	Probable	Improbable: too sandy.	Poor: too sandy.
91D, 91F: Plainfield	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
92B: Selfridge	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
93*. Pits				
94B: Brems	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
95A: Abscota	Fair: wetness.	Probable	Improbable: too sandy.	Poor: too sandy.
96A*:				
Pipestone	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
Kingsville	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
97B*: Urban land.				
Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
98F*:				
Plainfield	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Perrinton	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
111B, 111C, 112B: Plainfield	Good	Probable	Improbable: too sandy.	Poor: too sandy.
115B*:				
Plainfield, banded substratum	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Plainfield, loamy substratum	Good	Probable	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
121B, 121C, 122B------ Grattan	Good------------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
125B*:				
Grattan---------------	Good------------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
Spinks----------------	Good------------------	Probable-------------	Improbable: too sandy.	Fair: too sandy.
125C*:				
Grattan---------------	Good------------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
Spinks----------------	Good------------------	Probable-------------	Improbable: too sandy.	Fair: slope, too sandy.
125E*:				
Grattan---------------	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
Spinks----------------	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: slope.
130B*, 130C*:				
Grattan---------------	Good------------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
Coloma----------------	Good------------------	Probable-------------	Improbable: too sandy.	Poor: too sandy, small stones.
130E*:				
Grattan---------------	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.
Coloma----------------	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, small stones, slope.
131B*, 131C*:				
Grattan---------------	Good------------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
Coloma----------------	Good------------------	Probable-------------	Improbable: too sandy.	Poor: too sandy, small stones.
131E*:				
Grattan---------------	Fair: slope.	Probable-------------	Improbable: too sandy.	Poor: too sandy, slope.

See footnote at end of table.

TABLE 15.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
131E*:				
Coloma	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, small stones, slope.
135B*, 135C*:				
Grattan	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
135E*:				
Grattan	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Metea	Fair: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
135F*:				
Grattan	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Metea	Poor: slope.	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy, slope.
137B*, 137C*:				
Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
Tustin	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
147C*:				
Marlette	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
181, 182 Histosols	Poor: wetness, low strength.	Improbable: excess humus.	Improbable: too sandy, excess humus.	Poor: excess humus, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
2 Glendora	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, droughty.
3 Adrian	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Wetness, rooting depth.
4A Cosad	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: no water.	Percs slowly	Wetness, droughty, fast intake.	Wetness, droughty, percs slowly.
5B Pipestone	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
8 Cohoctah	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness, flooding.	Wetness.
10B, 10B3 Sparta	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
10C Sparta	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
11 Martisco	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly.	Ponding, soil blowing, percs slowly.	Wetness, percs slowly.
13B*:						
Selfridge	Severe: seepage.	Moderate: piping, wetness.	Severe: no water.	Frost action	Wetness, droughty.	Wetness, erodes easily, droughty.
Capac	Slight	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Wetness.
14B Dixboro	Moderate: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness, fast intake.	Wetness.
15B Capac	Slight	Severe: piping, wetness.	Severe: slow refill.	Frost action	Wetness	Wetness.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
16------------------ Napoleon	Severe: seepage.	Severe: excess humus, ponding.	Moderate: slow refill.	Ponding, subsides, frost action.	Ponding, too acid.	Wetness.
17B*:						
Spinks------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Metea-------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Coloma------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
17C*:						
Spinks------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Metea-------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Coloma------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
17D*:						
Spinks------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Metea-------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
19B--------------- Covert	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty.
20---------------- Granby	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
21---------------- Kingsville	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
22B--------------- Scalley	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope----------	Favorable.
22C, 22D---------- Scalley	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope----------	Slope.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
23---------------- Lamson	Severe: seepage.	Severe: piping, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Wetness, fast intake, soil blowing.	Wetness.
24---------------- Edwards	Severe: seepage.	Severe: ponding.	Severe: slow refill.	Frost action, ponding, subsides.	Ponding, soil blowing.	Wetness.
27---------------- Granby	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
28B--------------- Watseka	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
29B--------------- Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
29C, 29D---------- Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
32---------------- Carlisle	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
36B--------------- Del Rey	Slight---------	Severe: wetness.	Severe: slow refill.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.
39B--------------- Boyer	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
39C, 39D, 39E----- Boyer	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
40B--------------- Tustin	Severe: seepage.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
40C--------------- Tustin	Severe: seepage, slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
41B--------------- Marlette	Moderate: slope.	Severe: piping.	Severe: slow refill.	Slope----------	Slope, wetness.	Rooting depth.
41C, 41C2, 41D---- Marlette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, rooting depth.
42B*:						
Metea------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
42B*:						
Marlette	Moderate: slope.	Severe: piping.	Severe: slow refill.	Slope	Slope, wetness.	Rooting depth.
Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
42C*, 42C2*:						
Metea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Marlette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, rooting depth.
Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
42D*:						
Metea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Marlette	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, rooting depth.
42E*:						
Metea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
43B Metea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
43C Metea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
44B Spinks	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
44C, 44D, 44E Spinks	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
46B Perrinton	Moderate: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly, erodes easily.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
46C, 46D, 46F----- Perrinton	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
47B--------------- Toogood	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
47C, 47D---------- Toogood	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
49B--------------- Toogood	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty.
51B--------------- Thetford	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
52---------------- Linwood	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing, rooting depth.	Large stones, wetness, rooting depth.
53---------------- Parkhill	Slight---------	Severe: thin layer, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding--------	Wetness, erodes easily.
55---------------- Sickles	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: slow refill, cutbanks cave.	Ponding, percs slowly, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty, rooting depth.
60B--------------- Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
60C, 60D---------- Grattan	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
62---------------- Jebavy	Severe: seepage, cemented pan.	Severe: seepage, piping, ponding.	Severe: no water.	Ponding: percs slowly, cemented pan.	Ponding, droughty.	Wetness: droughty, cemented pan.
65---------------- Wauseon	Severe: seepage.	Severe: hard to pack, ponding.	Severe: no water.	Ponding, percs slowly, frost action.	Ponding--------	Wetness, rooting depth.
70---------------- Udorthents	Variable-------	Variable-------	Variable-------	Variable-------	Variable-------	Variable.
72---------------- Udipsamments	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
82---------------- Algansee	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
88----------------- Ceresco	Severe: seepage.	Severe: piping, wetness.	Severe: cutbanks cave.	Flooding, frost action.	Wetness---------	Wetness.
90*:						
Histosols---------	Slight----------	Severe: excess humus, ponding.	Slight----------	Ponding, frost action.	Ponding---------	Wetness.
Aquents-----------	Slight----------	Severe: ponding.	Slight----------	Ponding, frost action.	Ponding---------	Wetness.
91B--------------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
91C, 91D, 91F----- Plainfield	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
92B--------------- Selfridge	Severe: seepage.	Moderate: piping, wetness.	Severe: no water.	Frost action---	Wetness, droughty.	Wetness, erodes easily, droughty.
93*. Pits						
94B--------------- Brems	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Droughty, rooting depth.
95A--------------- Abscota	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Droughty.
96A*:						
Pipestone---------	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Cutbanks cave	Wetness, droughty.	Wetness, droughty.
Kingsville--------	Severe: seepage.	Severe: seepage, piping, ponding.	Severe: cutbanks cave.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Wetness, droughty.
97B*: Urban land.						
Metea-------------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Marlette----------	Moderate: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Rooting depth.
98F*:						
Plainfield--------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
98F*:						
Perrinton--------	Severe: slope.	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
111B-------------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
111C-------------- Plainfield	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
112B-------------- Plainfield	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty, rooting depth.
115B*:						
Plainfield, banded substratum------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Plainfield, loamy substratum------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
121B-------------- Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
121C-------------- Grattan	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
122B-------------- Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
125B*:						
Grattan----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Spinks-----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
125C*, 125E*:						
Grattan----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Spinks-----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
130B*:						
Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
130C*, 130E*:						
Grattan	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
131B*:						
Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Coloma	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
131C*, 131E*:						
Grattan	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Coloma	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
135B*:						
Grattan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
Metea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.
135C*, 135E*, 135F*:						
Grattan	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Metea	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
137B*:						
Metea	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Droughty.

See footnote at end of table.

TABLE 16.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Grassed waterways
137B*:						
Tustin-----------	Severe: seepage.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Erodes easily, droughty.
137C*:						
Metea------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
Tustin-----------	Severe: seepage, slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, erodes easily, droughty.
147C*:						
Marlette---------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, rooting depth.
Metea------------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, droughty.
181, 182---------- Histosols	Severe: seepage.	Severe: excess humus, ponding.	Severe: cutbanks cave.	Ponding, frost action.	Ponding--------	Wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
2---------------- Glendora	0-5	Mucky sand-------	SP-SM, SM	A-1, A-2, A-4	0-5	95-100	90-100	45-85	10-45	---	NP
	5-60	Sandy loam, loamy sand, fine sandy loam.	SP-SM	A-4, A-2-4, A-1-B	0-5	95-100	90-100	45-85	10-50	---	NP
3---------------- Adrian	0-19	Muck-------------	PT	A-8	---	---	---	---	---	---	---
	19-60	Sand, fine sand, loamy sand.	SP, SM	A-2, A-3, A-1	0	95-100	75-100	30-80	0-35	---	NP
4A--------------- Cosad	0-12	Loamy sand-------	SM, SW-SM, SP-SM SP-SM	A-2, A-1	0	100	90-100	50-75	10-35	---	NP
	12-21	Loamy sand-------	SM, SW, SW-SM, SP-SM	A-2, A-1, A-3	0	100	90-100	50-75	10-35	---	NP
	21-60	Silty clay loam	CL, CL-ML	A-7, A-4, A-6	0	100	90-100	90-100	75-90	20-50	5-30
5B--------------- Pipestone	0-13	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-80	5-35	---	NP
	13-29	Sand-------------	SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-80	5-15	---	NP
	29-60	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-80	5-30	---	NP
8---------------- Cohoctah	0-11	Fine sandy loam	ML, SM, SC, CL	A-4, A-2	0	100	100	60-95	30-65	<30	NP-10
	11-30	Loam, fine sandy loam, sandy loam.	ML, SM, SC, CL	A-4, A-2	0	95-100	85-100	70-90	30-70	<30	NP-10
	30-60	Loam, sandy loam, loamy fine sand.	ML, SM, SC, CL	A-4, A-2	0	95-100	85-100	65-90	20-70	<30	NP-10
10B-------------- Sparta	0-20	Sand-------------	SP-SM, SM	A-3, A-2	0	85-100	85-100	50-75	5-35	---	NP
	20-45	Fine sand, sand	SP-SM, SM	A-2, A-3,	0	85-100	85-100	50-95	5-35	---	NP
	45-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
10B3------------- Sparta	0-2	Sand-------------	SP-SM, SM	A-3, A-2	0	85-100	85-100	50-75	5-35	---	NP
	2-10	Fine sand, sand	SP-SM, SM	A-2, A-3,	0	85-100	85-100	50-95	5-35	---	NP
	10-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
10C-------------- Sparta	0-12	Sand-------------	SP-SM, SM	A-3, A-2	0	85-100	85-100	50-75	5-35	---	NP
	12-32	Fine sand, sand	SP-SM, SM	A-2, A-3,	0	85-100	85-100	50-95	5-35	---	NP
	32-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	85-100	85-100	50-95	2-30	---	NP
11--------------- Martisco	0-11	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	11-60	Marl-------------	---	---	0	---	---	---	---	---	---

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
13B*:											
Selfridge-------	0-12	Loamy sand-------	SM, SC-SM, SP-SM	A-2, A-1	0-5	95-100	90-100	45-80	10-35	<20	NP-5
	12-23	Sand, loamy sand, loamy fine sand.	SP-SM, SM, SC-SM	A-2, A-3, A-1	0-5	95-100	90-100	45-80	5-35	<20	NP-5
	23-37	Sandy loam, sandy clay loam, loam.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	95-100	85-100	50-95	25-75	15-35	NP-15
	37-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	70-100	50-95	25-45	10-20
Capac-----------	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-100	70-95	50-85	<25	3-10
	10-32	Loam, clay loam, sandy clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	75-100	50-85	25-45	5-20
	32-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	75-100	70-95	55-75	20-45	5-20
14B-------------- Dixboro	0-11	Loamy fine sand	SM, ML, SC-SM, CL-ML	A-2-4, A-4	0	100	100	70-95	20-60	<25	NP-6
	11-29	Very fine sandy loam, sandy loam, loamy very fine sand.	SM, ML, SC, CL	A-4	0	100	100	70-95	40-80	<25	2-10
	29-60	Stratified fine sand to silty clay loam.	SM, ML, SC, CL	A-2-4, A-4	0	100	95-100	70-95	20-90	<20	NP-8
15B-------------- Capac	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-100	70-95	50-85	<25	3-10
	10-32	Loam, clay loam, sandy clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	75-100	50-85	25-45	5-20
	32-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	75-100	70-95	55-75	20-45	5-20
16--------------- Napoleon	0-10	Peat-------------	PT	A-8	0	---	---	---	---	---	---
	10-60	Mucky peat-------	PT	A-8	0	---	---	---	---	---	---
17B*, 17C*:											
Spinks----------	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-27	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	27-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
Coloma----------	0-3	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-70	2-15	---	NP
	3-43	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-75	2-15	---	NP
	43-60	Stratified sand to loamy sand.	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-70	2-30	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
17D*:											
Spinks----------	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-27	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	27-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
19B-------------- Covert	0-4	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-15	---	NP
	4-24	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
	24-60	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-70	5-15	---	NP
20--------------- Granby	0-10	Mucky sand-------	SP-SM, SM	A-3, A-2-4	0	100	100	50-70	5-15	---	NP
	10-24	Sand-------------	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-70	5-15	---	NP
	24-60	Sand, fine sand	SP-SM, SM	A-3, A-2, A-1	0	100	95-100	45-70	5-15	---	NP
21--------------- Kingsville	0-7	Mucky sand-------	SM, SP-SM	A-2, A-1, A-3	0	100	90-100	45-70	5-15	---	NP
	7-60	Sand-------------	SM, SW-SM, SP-SM	A-2, A-3, A-4, A-1	0	95-100	85-100	45-70	5-15	---	NP
22B, 22C, 22D---- Scalley	0-7	Loam-------------	CL, CL-ML	A-4	0-5	95-100	85-100	70-90	50-75	20-30	4-10
	7-36	Clay loam--------	CL	A-6, A-7	0-5	95-100	85-100	70-95	50-85	30-45	10-20
	36-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-2-4, A-1-b, A-3	0-5	80-100	75-100	60-80	5-30	---	NP
23--------------- Lamson	0-9	Loamy fine sand	SM, ML	A-4, A-2	0	100	100	70-95	25-60	---	NP
	9-26	Sand, loamy fine sand, very fine sandy loam.	SM, ML	A-4, A-2	0	95-100	80-100	70-95	25-60	<20	NP-4
	26-60	Fine sand, very fine sand, loamy very fine sand.	SM, ML	A-2, A-4	0	95-100	80-100	60-90	20-65	---	NP
24--------------- Edwards	0-21	Muck-------------	PT	A-8	0	---	---	---	---	---	---
	21-60	Marl-------------	---	---	0	---	---	---	---	---	---
27--------------- Granby	0-13	Mucky sand-------	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	90-100	45-70	5-15	---	NP
	13-40	Loamy sand, coarse sand.	SP-SM, SM	A-3, A-2, A-1-b	0	95-100	90-100	45-75	5-30	---	NP
	40-60	Gravelly loamy sand, gravelly sand.	SP-SM, SM, SP	A-3, A-2, A-1	0	60-85	50-75	30-55	0-20	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
28B-------------- Watseka	0-14	Loamy sand-------	SM, SC-SM	A-2	0	100	95-100	80-100	17-35	<25	NP-5
	14-60	Fine sand, sand, loamy fine sand.	SP, SM, SP-SM	A-3, A-2	0	90-100	90-100	60-80	3-25	<20	NP-4
29B, 29C, 29D---- Coloma	0-3	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-7	95-100	75-100	50-70	2-15	---	NP
	3-43	Sand-------------	SP, SM, SP-SM	A-2, A-3	0-7	95-100	75-100	50-70	2-15	---	NP
	43-60	Stratified sand to loamy sand.	SP, SM, SP-SM	A-2, A-3	0-7	95-100	75-100	50-100	2-30	---	NP
32--------------- Carlisle	0-60	Muck-------------	PT	A-8	0-30	---	---	---	---	---	---
36B-------------- Del Rey	0-15	Loam-------------	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	25-45	10-25
	15-19	Clay loam, silty clay loam.	CH, CL	A-7	0	95-100	95-100	90-100	75-95	40-55	20-30
	19-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	30-45	10-25
39B, 39C, 39D, 39E------------- Boyer	0-10	Loamy sand-------	SM, SP-SM	A-2, A-1	0-5	95-100	75-95	30-80	10-35	<20	NP-4
	10-18	Loamy sand, loamy fine sand, fine sandy loam.	SM, SC-SM, ML, CL-ML	A-2, A-4, A-1-b	0-5	85-100	75-95	30-85	12-55	<20	NP-4
	18-30	Gravelly sandy loam, sandy loam, gravelly sandy clay loam.	SC, SC-SM, CL, CL-ML	A-2, A-4, A-1-b	0-5	80-100	60-95	35-90	15-75	20-30	5-10
	30-60	Gravelly sand, gravelly coarse sand, very gravelly sand.	SP, SP-SM, GP, GP-GM	A-1, A-2, A-3	0-10	40-95	30-85	20-60	0-10	---	NP
40B, 40C--------- Tustin	0-6	Loamy sand-------	SM	A-2	0	100	100	60-100	15-25	---	NP
	6-21	Loamy fine sand, fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	---	NP
	21-60	Silty clay, silty clay loam, clay.	CL, CH	A-7	0-3	90-100	90-100	85-100	65-100	40-80	20-50
41B-------------- Marlette	0-10	Loam-------------	CL-ML, ML, CL	A-4	0-5	95-100	85-95	70-95	50-70	20-30	3-10
	10-29	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
41C-------------- Marlette	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	70-95	50-70	20-30	3-10
	10-29	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
41C2------------- Marlette	0-10	Loam-------------	CL, CL-ML	A-4	0-5	95-100	85-95	70-95	50-70	20-30	5-10
	10-23	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7-6	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	23-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
41D-------------- Marlette	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	70-95	50-70	20-30	3-10
	10-29	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
42B*:											
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
Marlette--------	0-10	Loam-------------	CL-ML, ML, CL	A-4	0-5	95-100	85-95	70-95	50-70	20-30	3-10
	10-29	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
Spinks----------	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-27	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	27-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
42C*:											
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
Marlette--------	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	70-95	50-70	20-30	3-10
	10-29	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
Spinks----------	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-27	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	27-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
42C2*:											
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
Marlette--------	0-10	Loam-------------	CL, CL-ML	A-4	0-5	95-100	85-95	70-95	50-70	20-30	5-10
	10-25	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7-6	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	25-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
42C2*:											
Spinks----------	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-23	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	23-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
42D*:											
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
Spinks----------	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-27	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	27-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
Marlette--------	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	70-95	50-70	20-30	3-10
	10-29	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
42E*:											
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
Spinks----------	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-27	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	27-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
43B, 43C--------- Metea	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
44B, 44C, 44D, 44E------------ Spinks	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-27	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	27-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
46B, 46C, 46D, 46F------------- Perrinton	0-4	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-95	50-75	20-35	4-15
	4-26	Silt loam, silty clay loam, silty clay.	CL, CH	A-7	0-5	95-100	85-100	80-100	60-90	40-60	20-35
	26-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	55-90	35-60	15-35
47B, 47C, 47D, 49B------------- Toogood	0-4	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0-5	85-100	75-100	35-75	10-30	<20	NP-5
	4-34	Loamy sand, sand, gravelly sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0-5	80-100	70-100	35-75	5-30	<20	NP-5
	34-36	Gravelly sandy loam.	SC, SC-SM	A-1-b, A-2-4	0-5	80-85	70-75	40-55	20-35	20-30	5-10
	36-60	Gravelly coarse sand, gravelly loamy sand, very gravelly coarse sand.	GP-GM, GP, SP-SM, SP	A-1-a, A-1-b	0-5	40-70	30-60	5-45	0-15	<20	NP
51B-------------- Thetford	0-9	Loamy fine sand	SM, SC-SM, SP-SM	A-2, A-4, A-1-b	0	95-100	90-100	45-80	10-45	<25	NP-7
	9-26	Sand, loamy sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2, A-3, A-1-b	0	95-100	90-100	45-80	5-35	<25	NP-7
	26-50	Loamy sand, fine sandy loam, loamy fine sand.	SM, SC-SM, SC	A-2, A-4	0	95-100	90-100	60-80	20-50	<30	NP-10
	50-60	Very fine sand, fine sand, sand.	SM, SP, SP-SM	A-2, A-4, A-3	0	85-100	75-100	50-85	0-45	<20	NP-4
52--------------- Linwood	0-6	Muck-------------	PT	A-8	0-20	---	---	---	---	---	---
	6-29	Muck-------------	PT	A-8	0-20	---	---	---	---	---	---
	29-60	Sandy loam, silty clay loam, clay loam.	CL, ML, SC-SM, SC	A-4, A-6, A-2, A-1	0-10	90-100	75-100	45-100	20-95	15-40	NP-20
53--------------- Parkhill	0-9	Loam-------------	CL-ML, CL	A-4, A-6	0-5	95-100	85-100	70-95	50-75	20-30	5-15
	9-20	Clay loam, loam	CL	A-6, A-7	0-5	95-100	85-100	70-100	60-95	25-45	10-25
	20-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-95	50-90	20-35	5-15
55--------------- Sickles	0-8	Loamy fine sand	SM, SP-SM, SC-SM	A-2-4	0	95-100	90-100	50-75	10-30	<20	NP-6
	8-27	Sand, fine sand, loamy fine sand.	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	50-75	5-30	<25	NP-6
	27-60	Silty clay loam, silty clay.	CH, CL	A-7	0	95-100	90-100	90-100	75-95	42-60	29-40
60B, 60C, 60D---- Grattan	0-6	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	3-15	---	NP
	6-20	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	3-15	---	NP
	20-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
62---------------Jebavy	0-4	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	45-70	5-15	---	NP
	4-11	Sand-------------	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	45-70	5-15	---	NP
	11-29	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	45-70	5-15	---	NP
	29-60	Sand, fine sand	SP-SM, SM	A-3, A-2-4	0	95-100	90-100	45-90	5-15	---	NP
65---------------Wauseon	0-17	Loam-------------	ML, CL, CL-ML	A-4	0	100	95-100	80-95	60-80	<35	NP-10
	17-28	Loam-------------	ML, CL, CL-ML	A-4	0	100	95-100	80-95	60-80	<35	NP-10
	28-60	Clay, silty clay, silty clay loam.	CH, CL, MH, ML	A-7	0-2	90-100	85-100	80-100	75-95	40-70	18-36
70---------------Udorthents	0-60	Loam-------------	---	---	---	---	---	---	---	---	NP-15
	60-80	Variable---------	---	---	---	---	---	---	---	---	---
72---------------Udipsamments	0-60	Sand-------------	SP, SP-SM, SM	A-1, A-2, A-3	0	85-100	80-100	30-75	0-25	---	NP
82---------------Algansee	0-7	Loamy fine sand	SM, SC-SM	A-2-4	0	100	100	50-75	15-35	<25	NP-7
	7-60	Stratified sand to loamy fine sand.	SM, SP-SM	A-3, A-2-4	0	100	100	50-80	5-35	---	NP
88---------------Ceresco	0-11	Fine sandy loam	SM, SC-SM	A-2, A-4	0	100	100	60-90	30-50	<29	NP-7
	11-30	Sandy loam, loamy sand, very fine sandy loam.	SC-SM, CL, SC, CL-ML	A-2, A-4	0	100	100	60-95	15-80	20-30	4-10
	30-60	Sandy loam, fine sandy loam, very fine sandy loam.	SC, SC-SM, CL, CL-ML	A-2, A-4	0	100	100	60-100	30-80	20-30	4-10
90*:											
Histosols-------	0-51	Muck-------------	PT	A-8	0	---	---	---	---	---	NP
	51-60	Variable---------	---	---	---	---	---	---	---	---	---
Aquents---------	0-60	Variable---------	---	---	---	---	---	---	---	---	---
91B, 91C, 91D, 91F-------------Plainfield	0-2	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	85-100	75-100	40-80	3-15	---	NP
	2-27	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	85-100	75-100	40-70	1-15	---	NP
	27-60	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	85-100	75-100	40-90	1-15	---	NP
92B-------------Selfridge	0-14	Loamy sand-------	SM, SC-SM, SP-SM	A-2, A-1	0-5	95-100	90-100	45-80	10-35	<20	NP-5
	14-26	Sand, loamy sand	SP-SM, SM, SC-SM	A-2, A-3, A-1	0-5	95-100	90-100	45-80	5-35	<20	NP-5
	26-37	Silty clay loam, sandy clay loam, loam.	SM, SC, ML, CL	A-2, A-4, A-6	0-5	95-100	85-100	50-95	25-85	15-35	NP-15
	37-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	70-100	50-80	25-45	10-20
93*. Pits											

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag-ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
94B-------------- Brems	0-8	Sand-------------	SM, SP-SM	A-2-4, A-3	0	100	85-100	50-85	5-15	---	NP
	8-46	Sand, loamy sand	SM, SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-15	---	NP
	46-60	Sand-------------	SP-SM	A-3, A-2-4	0	100	80-100	50-85	5-10	---	NP
95A-------------- Abscota	0-9	Loamy sand-------	SM	A-2-4	0	95-100	95-100	50-75	15-30	---	NP
	9-16	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-2-4, A-1, A-3	0	95-100	85-100	45-65	5-30	---	NP
	16-60	Sand, coarse sand.	SP-SM, SP, SM	A-1, A-3, A-2-4	0	90-100	75-100	35-70	0-15	---	NP
96A*: Pipestone-------	0-13	Sand-------------	SM, SP-SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-70	5-15	---	NP
	13-29	Sand-------------	SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	40-70	5-15	---	NP
	29-60	Sand-------------	SP-SM, SM	A-3, A-2-4, A-1-b	0	95-100	85-100	40-70	5-15	---	NP
Kingsville------	0-7	Mucky sand-------	SM, SP-SM	A-2, A-1, A-3	0	100	90-100	45-70	5-15	---	NP
	7-60	Sand-------------	SM, SW-SM, SP-SM	A-2, A-3, A-1	0	95-100	85-100	45-70	5-15	---	NP
97B*: Urban land.											
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-28	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	28-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
Marlette--------	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	70-95	50-70	20-30	3-10
	10-29	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
98F*: Plainfield------	0-2	Sand-------------	SP-SM, SM, SP	A-3, A-2, A-1	0	85-100	75-100	40-70	3-15	---	NP
	2-27	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	85-100	75-100	40-70	1-15	---	NP
	27-60	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	85-100	75-100	40-70	1-15	---	NP
Perrinton-------	0-4	Loam-------------	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-95	50-75	20-35	4-15
	4-26	Silt loam, silty clay loam, silty clay.	CL, CH	A-7	0-5	95-100	85-100	80-100	60-90	40-60	20-35
	26-60	Clay loam, silty clay loam, clay.	CL, CH	A-6, A-7	0-5	95-100	85-100	75-100	55-90	35-60	15-35

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
111B, 111C-------Plainfield	0-2	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	2-27	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	27-60	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	60-99	Stratified sand to sandy clay loam.	SP, SM, SC-SM, SC	A-3, A-1, A-2, A-4	0	90-100	85-100	40-70	5-40	<30	NP-70
112B-------------Plainfield	0-2	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	2-27	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	27-99	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
115B*:											
Plainfield, banded substratum-----	0-2	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	2-27	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	27-60	Sand-------------	SP, SM, SP-SM	A-3, A-1, A-2	0	90-100	85-100	40-70	5-15	---	NP
	60-99	Stratified sand to sandy clay loam.	SP, SM, SC-SM, SC	A-3, A-1, A-2, A-4	0	90-100	85-100	40-70	5-40	<30	NP-70
Plainfield, loamy substratum-----	0-3	Sand-------------	SP, SP-SM, SM	A-3, A-2, A-1	0	90-100	85-100	40-70	3-35	---	NP
	3-50	Sand-------------	SP, SP-SM, SM	A-2, A-3, A-1	0	90-100	85-100	40-70	1-15	---	NP
	50-99	Loam, sandy loam, silt loam.	CL, SC, ML, SM	A-4, A-6	0-5	85-100	80-95	60-90	35-80	25-40	7-16
121B, 121C-------Grattan	0-6	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	6-20	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	20-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	60-99	Stratified sand to sandy loam.	SP, SM, SC-SM, SC	A-3, A-1, A-2, A-4	0	95-100	85-100	40-70	1-40	0-30	NP-10
122B-------------Grattan	0-6	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	3-15	---	NP
	6-20	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	3-15	---	NP
	20-99	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	3-15	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
125B*, 125C*, 125E*:											
Grattan--------	0-6	Sand------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	6-20	Sand------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	20-60	Sand------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	60-99	Stratified sand to sandy loam.	SP, SM, SC-SM, SC	A-3, A-1, A-2, A-4	0	95-100	85-100	40-70	1-40	0-30	NP-10
Spinks---------	0-11	Loamy sand-------	SM, SC-SM, SP-SM	A-2-4, A-1-b	0	95-100	80-100	35-90	10-30	<25	NP-7
	11-27	Loamy sand, sand, fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3, A-1-b	0	95-100	80-100	35-90	5-35	<25	NP-7
	27-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM, SC-SM	A-2-4, A-1-b	0	95-100	80-100	40-90	10-35	<25	NP-7
130B*, 130C*, 130E*:											
Grattan--------	0-6	Sand------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	3-15	---	NP
	6-20	Sand------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	45-70	3-15	---	NP
	20-60	Sand, coarse sand	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	90-100	35-70	0-15	---	NP
Coloma---------	0-3	Sand------------	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-70	2-15	---	NP
	3-43	Sand------------	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-70	2-15	---	NP
	43-60	Stratified sand to loamy sand.	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-70	2-30	---	NP
131B*, 131C*, 131E*:											
Grattan--------	0-6	Sand------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	6-20	Sand------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	20-60	Sand------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	60-99	Stratified sand to sandy loam.	SP, SM, SC-SM, SC	A-3, A-1, A-2, A-4	0	95-100	85-100	40-70	1-40	0-30	NP-10
Coloma---------	0-3	Sand------------	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-70	2-15	---	NP
	3-43	Sand------------	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-70	2-15	---	NP
	43-60	Stratified sand to loamy sand.	SP, SM, SP-SM	A-2, A-3	0-7	85-100	75-100	50-70	2-30	---	NP

See footnote at end of table.

TABLE 17.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
135B*, 135C*, 135E*, 135F*:											
Grattan--------	0-6	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	6-20	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	20-60	Sand-------------	SP, SP-SM, SM	A-2-4, A-3, A-1-b	0	95-100	85-100	45-70	1-15	---	NP
	60-99	Stratified sand to sandy loam.	SP, SM, SC-SM, SC	A-3, A-1, A-2, A-4	0	95-100	85-100	40-70	1-40	0-30	NP-10
Metea----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
137B*, 137C*:											
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
Tustin----------	0-6	Loamy sand-------	SM	A-2	0	100	100	60-100	15-25	---	NP
	6-21	Loamy fine sand, fine sand, sand.	SM, SP-SM	A-2, A-3	0	100	100	50-100	5-35	---	NP
	21-60	Silty clay, silty clay loam, clay loam.	CL, CH	A-7	0-3	90-100	90-100	85-100	65-100	40-80	20-50
147C*:											
Marlette--------	0-10	Loam-------------	CL, ML, CL-ML	A-4	0-5	95-100	85-95	70-95	50-70	20-30	3-10
	10-29	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-95	80-95	55-90	20-45	5-25
	29-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-95	75-95	50-75	20-40	5-25
Metea-----------	0-8	Loamy sand-------	SM	A-2-4	0	100	100	50-80	15-35	---	---
	8-32	Loamy sand, loamy fine sand, sand.	SP-SM, SM	A-2-4	0	100	100	50-80	5-35	---	---
	32-48	Clay loam, loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	11-16
	48-60	Loam-------------	CL-ML, CL	A-4	0-3	85-95	75-95	65-90	50-75	20-30	5-10
181, 182--------- Histosols	0-40	Muck-------------	PT	A-8	0	---	---	---	---	---	NP
	40-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	100	100	50-90	5-30	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
2---------------- Glendora	0-5	0-10	1.00-1.35	6.0-20	0.11-0.13	5.1-7.8	Low-----------	0.15	5	1	10-15
	5-60	0-10	1.40-1.65	6.0-20	0.05-0.11	5.6-8.4	Low-----------	0.17			
3---------------- Adrian	0-19	---	0.30-0.55	0.2-6.0	0.35-0.45	5.1-7.3	---	---	4	2	55-75
	19-60	2-10	1.40-1.75	6.0-20	0.03-0.08	5.6-8.4	Low-----------	0.15			
4A--------------- Cosad	0-12	2-12	1.20-1.50	6.0-20	0.10-0.12	5.1-7.3	Low-----------	0.17	3	2	---
	12-21	2-12	1.20-1.50	6.0-20	0.05-0.07	5.1-8.4	Low-----------	0.17			
	21-60	30-40	1.15-1.40	0.06-0.2	0.12-0.17	6.6-8.4	Moderate-----	0.28			
5B--------------- Pipestone	0-13	2-10	1.30-1.50	6.0-20	0.07-0.10	4.5-7.3	Low-----------	0.15	5	1	3-4
	13-29	2-10	1.40-1.70	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.15			
	29-60	2-10	1.40-1.65	6.0-20	0.05-0.07	4.5-7.3	Low-----------	0.15			
8---------------- Cohoctah	0-11	5-20	1.20-1.50	2.0-6.0	0.13-0.22	6.1-7.8	Low-----------	0.24	5	3	3-15
	11-30	5-27	1.45-1.65	2.0-6.0	0.12-0.20	6.1-8.4	Low-----------	0.28			
	30-60	2-25	1.45-1.65	2.0-6.0	0.08-0.20	6.1-8.4	Low-----------	0.28			
10B-------------- Sparta	0-20	1-5	1.30-1.50	6.0-20	0.06-0.09	<5.6	Low-----------	0.15	5	1	.5-2
	20-45	1-8	1.40-1.60	6.0-20	0.05-0.11	4.5-5.5	Low-----------	0.15			
	45-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-6.5	Low-----------	0.15			
10B3------------- Sparta	0-2	1-5	1.30-1.50	6.0-20	0.06-0.09	<5.6	Low-----------	0.15	5	1	.5-2
	2-10	1-8	1.40-1.60	6.0-20	0.05-0.11	4.5-5.5	Low-----------	0.15			
	10-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-6.5	Low-----------	0.15			
10C-------------- Sparta	0-12	1-5	1.30-1.50	6.0-20	0.06-0.09	<5.6	Low-----------	0.15	5	1	.5-2
	12-32	1-8	1.40-1.60	6.0-20	0.05-0.11	4.5-5.5	Low-----------	0.15			
	32-60	0-5	1.50-1.70	6.0-20	0.04-0.07	5.1-6.5	Low-----------	0.15			
11--------------- Martisco	0-11	---	0.13-0.23	0.6-6.0	0.35-0.45	6.1-8.4	---	---	3	2	25-75
	11-60	---	---	0.06-0.2	---	7.9-8.4	---	---			
13B*:											
Selfridge-------	0-12	2-15	1.25-1.40	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	1-3
	12-23	2-15	1.30-1.60	6.0-20	0.07-0.11	5.1-7.3	Low-----------	0.17			
	23-37	8-18	1.35-1.45	6.0-20	0.12-0.14	5.6-7.3	Low-----------	0.28			
	37-60	18-35	1.50-1.70	0.2-0.6	0.10-0.14	7.4-8.4	Low-----------	0.37			
Capac-----------	0-10	10-18	1.40-1.70	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.32	5	5	2-6
	10-32	18-35	1.45-1.70	0.2-0.6	0.14-0.18	5.6-7.3	Low-----------	0.32			
	32-60	10-35	1.50-1.70	0.2-0.6	0.14-0.17	7.4-8.4	Low-----------	0.32			
14B-------------- Dixboro	0-11	2-12	1.30-1.65	2.0-6.0	0.10-0.14	5.6-7.3	Low-----------	0.20	5	2	2-3
	11-29	6-17	1.40-1.70	0.6-2.0	0.15-0.20	5.6-7.3	Low-----------	0.32			
	29-60	0-15	1.50-1.65	0.6-2.0	0.07-0.20	6.6-8.4	Low-----------	0.24			
15B-------------- Capac	0-10	10-18	1.40-1.70	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.32	5	5	2-6
	10-32	18-35	1.45-1.70	0.2-0.6	0.14-0.18	5.6-7.3	Low-----------	0.32			
	32-60	10-35	1.50-1.70	0.2-0.6	0.14-0.17	7.4-8.4	Low-----------	0.32			
16--------------- Napoleon	0-10	---	0.30-0.40	>6.0	0.55-0.65	<4.5	---	---	5	7	70-90
	10-60	---	0.10-0.20	0.6-6.0	0.45-0.55	<4.5	---	---			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
17B*, 17C*:											
Spinks----------	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low----------	0.17	5	2	2-4
	11-27	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low----------	0.17			
	27-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low----------	0.17			
Metea-----------	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			
Coloma----------	0-3	0-10	1.35-1.65	6.0-20	0.05-0.09	4.5-7.3	Low----------	0.15	5	1	.5-2
	3-43	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low----------	0.15			
	43-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low----------	0.15			
17D*:											
Spinks----------	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low----------	0.17	5	2	2-4
	11-27	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low----------	0.17			
	27-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low----------	0.17			
Metea-----------	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			
19B-------------- Covert	0-4	2-10	1.30-1.55	6.0-20	0.06-0.09	4.5-7.3	Low----------	0.15	5	1	1-2
	4-24	2-10	1.30-1.60	6.0-20	0.05-0.08	4.5-7.3	Low----------	0.15			
	24-60	0-10	1.45-1.65	6.0-20	0.04-0.07	5.1-7.3	Low----------	0.15			
20--------------- Granby	0-10	0-10	1.10-1.20	6.0-20	0.12-0.16	5.6-7.3	Low----------	0.15	5	1	10-15
	10-24	0-10	1.45-1.60	6.0-20	0.05-0.12	5.6-7.8	Low----------	0.15			
	24-60	0-10	1.45-1.60	6.0-20	0.05-0.12	6.6-8.4	Low----------	0.15			
21--------------- Kingsville	0-7	2-10	0.60-1.00	6.0-20	0.16-0.18	4.5-6.0	Low----------	0.15	5	1	15-25
	7-60	2-10	1.45-1.65	6.0-20	0.05-0.10	5.6-7.3	Low----------	0.17			
22B, 22C, 22D---- Scalley	0-7	10-18	1.30-1.60	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.32	4	5	1-3
	7-36	27-35	1.35-1.55	0.2-0.6	0.14-0.20	5.6-7.3	Low----------	0.32			
	36-60	0-15	1.55-1.70	>6.0	0.02-0.10	5.6-7.8	Low----------	0.15			
23--------------- Lamson	0-9	1-10	1.10-1.40	0.6-6.0	0.11-0.13	5.6-7.8	Low----------	0.20	5	2	3-10
	9-26	5-18	1.25-1.55	0.6-2.0	0.12-0.17	6.1-8.4	Low----------	0.20			
	26-60	1-10	1.45-1.65	0.6-2.0	0.02-0.04	6.1-8.4	Low----------	0.20			
24--------------- Edwards	0-21	---	0.30-0.55	0.2-6.0	0.35-0.45	4.5-7.8	---	---	4	2	55-75
	21-60	---	---	0.06-0.2	---	7.0-8.4	---	---			
27--------------- Granby	0-13	0-10	1.10-1.20	6.0-20	0.12-0.16	5.6-7.3	Low----------	0.15	5	1	10-15
	13-40	0-12	1.45-1.60	6.0-20	0.06-0.11	5.6-7.8	Low----------	0.15			
	40-60	0-12	1.50-1.60	>20	0.02-0.05	6.6-8.4	Low----------	0.10			
28B-------------- Watseka	0-14	8-13	1.35-1.55	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	1-3
	14-60	1-10	1.50-1.70	6.0-20	0.05-0.10	5.1-7.8	Low----------	0.17			
29B, 29C, 29D---- Coloma	0-3	0-10	1.35-1.65	6.0-20	0.05-0.09	4.5-7.3	Low----------	0.15	5	1	.5-2
	3-43	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low----------	0.15			
	43-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low----------	0.15			
32--------------- Carlisle	0-60	---	0.13-0.23	0.2-6.0	0.35-0.45	4.5-7.8	---	---	5	2	>70

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
36B-------------- Del Rey	0-15	15-27	1.30-1.50	0.6-2.0	0.22-0.24	4.5-7.3	Low----------	0.43	3	6	2-3
	15-19	25-45	1.40-1.65	0.06-0.2	0.12-0.20	4.5-8.4	Moderate-----	0.43			
	19-60	25-35	1.50-1.70	0.06-0.2	0.09-0.11	7.9-8.4	Moderate-----	0.43			
39B, 39C, 39D, 39E------------- Boyer	0-10	0-10	1.35-1.60	6.0-20	0.08-0.12	5.6-7.3	Low----------	0.17	4	2	.5-3
	10-18	2-15	1.30-1.60	2.0-6.0	0.08-0.16	5.6-7.3	Low----------	0.17			
	18-30	10-18	1.35-1.60	2.0-6.0	0.11-0.13	5.6-7.8	Low----------	0.24			
	30-60	0-10	1.40-1.55	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
40B, 40C--------- Tustin	0-6	4-10	1.55-1.70	6.0-20	0.09-0.13	5.1-7.3	Low----------	0.17	4	2	.5-2
	6-21	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-7.3	Low----------	0.17			
	21-60	35-60	1.45-1.55	0.06-0.2	0.07-0.20	5.6-8.4	High---------	0.43			
41B-------------- Marlette	0-10	10-18	1.50-1.65	2.0-6.0	0.18-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
	10-29	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	29-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
41C-------------- Marlette	0-10	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
	10-29	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	29-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
41C2------------- Marlette	0-10	10-18	1.50-1.65	0.6-2.0	0.16-0.18	5.6-7.3	Low----------	0.32	5	5	1-2
	10-23	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	23-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
41D-------------- Marlette	0-10	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
	10-29	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	29-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
42B*:											
Metea-----------	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			
Marlette--------	0-10	10-18	1.50-1.65	2.0-6.0	0.18-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
	10-29	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	29-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
Spinks----------	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low----------	0.17	5	2	2-4
	11-27	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low----------	0.17			
	27-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low----------	0.17			
42C*:											
Metea-----------	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			
Marlette--------	0-10	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
	10-29	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	29-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
Spinks----------	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low----------	0.17	5	2	2-4
	11-27	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low----------	0.17			
	27-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low----------	0.17			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
42C2*:											
Metea	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.32			
Marlette	0-10	10-18	1.50-1.65	0.6-2.0	0.16-0.18	5.6-7.3	Low	0.32	5	5	1-2
	10-25	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low	0.32			
	25-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low	0.32			
Spinks	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low	0.17	5	2	2-4
	11-23	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low	0.17			
	23-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low	0.17			
42D*:											
Metea	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.32			
Spinks	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low	0.17	5	2	2-4
	11-27	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low	0.17			
	27-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low	0.17			
Marlette	0-10	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low	0.32	5	5	1-3
	10-29	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low	0.32			
	29-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low	0.32			
42E*:											
Metea	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.32			
Spinks	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low	0.17	5	2	2-4
	11-27	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low	0.17			
	27-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low	0.17			
43B, 43C Metea	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low	0.32			
44B, 44C, 44D, 44E Spinks	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low	0.17	5	2	2-4
	11-27	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low	0.17			
	27-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low	0.17			
46B, 46C, 46D, 46F Perrinton	0-4	10-27	1.50-1.70	0.6-2.0	0.20-0.24	5.6-7.8	Low	0.37	3	5	1-3
	4-26	35-50	1.50-1.70	0.06-0.2	0.10-0.20	5.6-8.4	Moderate	0.32			
	26-60	30-56	1.65-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate	0.32			
47B, 47C, 47D, 49B Toogood	0-4	2-10	1.25-1.55	6.0-20	0.06-0.09	5.1-7.3	Low	0.17	4	2	.5-2
	4-34	2-10	1.40-1.65	6.0-20	0.05-0.11	5.1-7.3	Low	0.17			
	34-36	10-20	1.35-1.65	6.0-20	0.09-0.12	5.6-7.3	Low	0.17			
	36-60	0-10	1.50-1.65	>20	0.02-0.04	7.9-8.4	Low	0.10			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
51B--------------Thetford	0-9	2-15	1.30-1.60	2.0-6.0	0.09-0.11	5.6-7.3	Low-----------	0.17	5	2	1-4
	9-26	2-15	1.30-1.60	2.0-20	0.07-0.11	5.6-7.3	Low-----------	0.17			
	26-50	8-18	1.45-1.65	2.0-6.0	0.06-0.08	5.6-7.8	Low-----------	0.17			
	50-60	0-10	1.45-1.65	6.0-20	0.05-0.08	5.1-8.4	Low-----------	0.15			
52---------------Linwood	0-6	---	0.15-0.40	0.2-6.0	0.35-0.45	4.5-7.8	---	---	4	2	40-70
	6-29	---	0.15-0.40	0.2-6.0	0.35-0.45	4.5-7.8	---	---			
	29-60	5-35	1.60-1.90	0.2-2.0	0.11-0.20	5.6-8.4	Low-----------	0.28			
53---------------Parkhill	0-9	10-20	1.10-1.60	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.24	5	5	3-5
	9-20	18-35	1.45-1.70	0.2-0.6	0.15-0.19	6.1-7.8	Moderate------	0.32			
	20-60	12-25	1.50-1.70	0.2-0.6	0.17-0.19	7.4-8.4	Low-----------	0.37			
55---------------Sickles	0-8	2-12	1.35-1.50	2.0-6.0	0.10-0.12	5.6-6.5	Low-----------	0.17	4	2	4-6
	8-27	2-12	1.40-1.55	6.0-20	0.06-0.11	6.1-7.3	Low-----------	0.17			
	27-60	35-50	1.50-1.75	<0.06	0.08-0.12	7.9-8.4	High----------	0.32			
60B, 60C, 60D----Grattan	0-6	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low-----------	0.15	5	1	2-8
	6-20	0-10	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	20-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low-----------	0.15			
62---------------Jebavy	0-4	0-10	0.60-1.60	6.0-20	0.07-0.09	3.6-5.5	Low-----------	0.15	2	1	2-7
	4-11	0-10	1.30-1.55	6.0-20	0.06-0.08	3.6-5.5	Low-----------	0.15			
	11-29	0-10	1.75-2.00	0.6-2.0	0.02-0.06	3.6-5.5	Low-----------	0.15			
	29-60	0-10	1.50-1.65	6.0-20	0.02-0.04	4.5-6.5	Low-----------	0.15			
65---------------Wauseon	0-17	7-18	1.30-1.50	2.0-6.0	0.20-0.22	6.1-7.3	Low-----------	0.28	4	5	4-8
	17-28	7-20	1.40-1.60	0.6-2.0	0.17-0.19	6.1-7.3	Low-----------	0.32			
	28-60	35-55	1.50-1.75	<0.2	0.08-0.18	7.4-8.4	High----------	0.32			
70---------------Udorthents	0-60	2-18	1.50-1.70	0.6-2.0	0.11-0.18	---	Low-----------	0.24	5	3	---
	60-80	---	---	---	---	---	---	---			
72---------------Udipsamments	0-60	0-10	1.35-1.65	>6.0	0.05-0.09	5.1-6.5	Low-----------	0.15	5	1	<1
82---------------Algansee	0-7	0-15	1.35-1.50	6.0-20	0.10-0.12	4.5-7.8	Low-----------	0.17	5	2	2-4
	7-60	0-15	1.40-1.65	6.0-20	0.05-0.10	4.5-8.4	Low-----------	0.17			
88---------------Ceresco	0-11	2-15	1.35-1.60	2.0-6.0	0.13-0.18	6.1-7.8	Low-----------	0.20	5	3	3-5
	11-30	10-18	1.40-1.70	0.6-2.0	0.09-0.17	6.1-7.8	Low-----------	0.24			
	30-60	10-18	1.40-1.70	0.6-2.0	0.11-0.20	6.6-8.4	Low-----------	0.24			
90*:											
Histosols--------	0-51	---	---	---	---	---	---	---	2	8	50-70
	51-60	---	---	---	---	---	---	---			
Aquents----------	0-60	---	---	---	---	---	---	---	---	---	---
91B, 91C, 91D, 91F-------------Plainfield	0-2	2-5	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low-----------	0.15	5	1	.5-2
	2-27	0-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low-----------	0.15			
	27-60	0-4	1.50-1.70	6.0-20	0.03-0.07	4.5-6.5	Low-----------	0.15			
92B--------------Selfridge	0-14	2-15	1.25-1.40	6.0-20	0.10-0.12	5.6-7.3	Low-----------	0.17	5	2	1-3
	14-26	2-15	1.30-1.60	6.0-20	0.07-0.11	5.1-7.3	Low-----------	0.17			
	26-37	8-18	1.35-1.45	6.0-20	0.12-0.14	5.6-7.3	Low-----------	0.28			
	37-60	18-35	1.50-1.70	0.2-0.6	0.10-0.14	7.4-8.4	Low-----------	0.37			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
93*. Pits											
94B-------------- Brems	0-8	2-6	1.50-1.65	6.0-20	0.07-0.09	5.1-6.5	Low-----------	0.15	5	1	.5-1
	8-46	2-6	1.60-1.75	6.0-20	0.05-0.08	4.5-6.0	Low-----------	0.17			
	46-60	2-6	1.60-1.75	6.0-20	0.05-0.07	5.1-6.5	Low-----------	0.17			
95A-------------- Abscota	0-9	2-15	1.30-1.60	6.0-20	0.10-0.12	6.1-7.3	Low-----------	0.17	5	2	.5-3
	9-16	0-10	1.35-1.60	6.0-20	0.05-0.11	6.1-7.8	Low-----------	0.17			
	16-60	0-10	1.45-1.60	6.0-20	0.05-0.07	6.1-8.4	Low-----------	0.15			
96A*:											
Pipestone-------	0-13	2-10	1.30-1.50	6.0-20	0.07-0.10	4.5-7.3	Low-----------	0.15	5	1	3-4
	13-29	2-10	1.40-1.70	6.0-20	0.06-0.09	4.5-7.3	Low-----------	0.15			
	29-60	2-10	1.40-1.65	6.0-20	0.05-0.07	4.5-7.3	Low-----------	0.15			
Kingsville------	0-7	2-10	0.60-1.00	6.0-20	0.16-0.18	4.5-6.0	Low-----------	0.15	5	1	15-25
	7-60	2-10	1.45-1.65	6.0-20	0.05-0.10	5.6-7.3	Low-----------	0.17			
97B*: Urban land.											
Metea-----------	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low-----------	0.17	5	2	.5-2
	8-28	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low-----------	0.17			
	28-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low-----------	0.32			
Marlette--------	0-10	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low-----------	0.32	5	5	1-3
	10-29	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low-----------	0.32			
	29-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low-----------	0.32			
98F*:											
Plainfield------	0-2	2-5	1.50-1.65	6.0-20	0.04-0.09	5.1-7.3	Low-----------	0.15	5	1	.5-2
	2-27	0-4	1.50-1.65	6.0-20	0.04-0.07	4.5-6.5	Low-----------	0.15			
	27-60	0-4	1.50-1.70	6.0-20	0.03-0.07	4.5-6.5	Low-----------	0.15			
Perrinton-------	0-4	10-27	1.50-1.70	0.6-2.0	0.20-0.24	5.6-7.8	Low-----------	0.37	3	5	1-3
	4-26	35-50	1.50-1.70	0.06-0.2	0.10-0.20	5.6-8.4	Moderate-----	0.32			
	26-60	30-56	1.65-1.70	0.06-0.2	0.14-0.20	7.9-8.4	Moderate-----	0.32			
111B, 111C------- Plainfield	0-2	0-4	1.50-1.65	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.15	5	1	.5-3
	2-27	0-4	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	27-60	0-4	1.50-1.70	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
	60-99	0-20	1.55-1.70	0.6-20	0.07-0.10	4.5-6.5	Low-----------	0.20			
112B------------- Plainfield	0-2	0-4	1.50-1.65	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.15	5	1	.5-2
	2-27	0-4	1.50-1.65	6.0-20	0.05-0.07	4.5-7.3	Low-----------	0.15			
	27-99	0-4	1.50-1.75	6.0-20	0.04-0.06	4.5-7.3	Low-----------	0.15			
115B*: Plainfield, banded substratum-----	0-2	0-4	1.50-1.65	6.0-20	0.06-0.08	5.1-7.3	Low-----------	0.15	5	1	.5-3
	2-27	0-4	1.50-1.65	6.0-20	0.05-0.07	4.5-6.5	Low-----------	0.15			
	27-60	0-4	1.50-1.70	6.0-20	0.04-0.06	4.5-6.5	Low-----------	0.15			
	60-99	0-20	1.55-1.70	0.6-20	0.07-0.10	4.5-6.5	Low-----------	0.20			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
115B*:											
Plainfield, loamy substratum-----	0-3	2-5	1.50-1.65	6.0-20	0.04-0.09	4.5-7.3	Low----------	0.15	5	1	.5-2
	3-50	1-4	1.50-1.70	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.17			
	50-99	15-27	1.60-1.70	0.6-2.0	0.13-0.18	5.1-8.4	Low----------	0.32			
121B, 121C------- Grattan	0-6	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	2-3
	6-20	0-10	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	20-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low----------	0.15			
	60-99	0-20	1.55-1.70	0.6-20	0.07-0.10	5.6-7.3	Low----------	0.17			
122B------------- Grattan	0-6	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	2-3
	6-20	0-10	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	20-99	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low----------	0.15			
125B*, 125C*, 125E*:											
Grattan--------	0-6	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	2-3
	6-20	0-10	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	20-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low----------	0.15			
	60-99	0-20	1.55-1.70	0.6-20	0.07-0.10	5.6-7.3	Low----------	0.17			
Spinks---------	0-11	2-15	1.40-1.70	6.0-20	0.08-0.10	5.1-7.3	Low----------	0.17	5	2	2-4
	11-27	0-15	1.40-1.70	2.0-20	0.05-0.10	5.6-7.3	Low----------	0.17			
	27-60	3-15	1.40-1.70	2.0-6.0	0.04-0.08	5.6-7.8	Low----------	0.17			
130B*, 130C*, 130E*:											
Grattan--------	0-6	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	2-8
	6-20	0-10	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	20-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low----------	0.15			
Coloma---------	0-3	0-10	1.35-1.65	6.0-20	0.05-0.09	4.5-7.3	Low----------	0.15	5	1	.5-2
	3-43	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low----------	0.15			
	43-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low----------	0.15			
131B*, 131C*, 131E*:											
Grattan--------	0-6	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	2-3
	6-20	0-10	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	20-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low----------	0.15			
	60-99	0-20	1.55-1.70	0.6-20	0.07-0.10	5.6-7.3	Low----------	0.17			
Coloma---------	0-3	0-10	1.35-1.65	6.0-20	0.05-0.09	4.5-7.3	Low----------	0.15	5	1	.5-2
	3-43	0-10	1.35-1.65	6.0-20	0.05-0.12	4.5-6.5	Low----------	0.15			
	43-60	2-12	1.50-1.65	6.0-20	0.03-0.08	4.5-6.0	Low----------	0.15			
135B*, 135C*, 135E*, 135F*:											
Grattan--------	0-6	0-10	1.35-1.55	6.0-20	0.06-0.08	4.5-6.5	Low----------	0.15	5	1	2-3
	6-20	0-10	1.40-1.60	6.0-20	0.05-0.07	4.5-6.5	Low----------	0.15			
	20-60	0-10	1.50-1.65	6.0-20	0.04-0.06	5.6-7.3	Low----------	0.15			
	60-99	0-20	1.55-1.70	0.6-20	0.07-0.10	5.6-7.3	Low----------	0.17			
Metea----------	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			

See footnote at end of table.

TABLE 18.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
137B*, 137C*:											
Metea-----------	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			
Tustin----------	0-6	4-10	1.55-1.70	6.0-20	0.09-0.13	5.1-7.3	Low----------	0.17	4	2	.5-2
	6-21	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-7.3	Low----------	0.17			
	21-60	35-60	1.45-1.55	0.06-0.2	0.07-0.20	5.6-8.4	High---------	0.43			
147C*:											
Marlette--------	0-10	10-18	1.50-1.65	0.6-2.0	0.18-0.22	5.6-7.3	Low----------	0.32	5	5	1-3
	10-29	18-35	1.50-1.75	0.2-0.6	0.18-0.20	5.6-7.8	Low----------	0.32			
	29-60	15-30	1.50-1.75	0.2-0.6	0.12-0.19	7.9-8.4	Low----------	0.32			
Metea-----------	0-8	3-8	1.55-1.65	6.0-20	0.10-0.13	5.6-7.3	Low----------	0.17	5	2	.5-2
	8-32	2-10	1.55-1.70	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	32-48	24-35	1.45-1.65	0.2-0.6	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	48-60	15-24	1.70-1.95	0.2-0.6	0.05-0.10	7.4-8.4	Low----------	0.32			
181, 182--------- Histosols	0-40	---	---	---	---	---	---	---	---	---	---
	40-60	---	---	---	---	---	---	---			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the t
< means less than; > means more than. Absence of an entry indicates that the feature is not a concern or th
not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Ri
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Unc s
					Ft			In	In		
2----------------- Glendora	A/D	Frequent----	Long------	Jan-Dec	0-1.0	Apparent	Nov-Jun	---	---	Moderate	Hig
3----------------- Adrian	A/D	None---------	---	---	+1-1.0	Apparent	Nov-May	6-18	29-33	High-----	Hig
4A---------------- Cosad	C	None---------	---	---	0.5-1.5	Perched	Nov-May	---	---	Moderate	Hig
5B---------------- Pipestone	B	None---------	---	---	0.5-1.5	Apparent	Oct-Jun	---	---	Moderate	Low
8----------------- Cohoctah	B/D	Frequent----	Brief to long.	Nov-Apr	0-1.0	Apparent	Sep-May	---	---	High-----	Hig
10B, 10B3, 10C---- Sparta	A	None---------	---	---	>6.0	---	---	---	---	Low------	Low
11---------------- Martisco	B/D	None---------	---	---	+1-0.5	Apparent	Oct-Jun	3-4	4-6	High-----	Hig
13B*:											
Selfridge---------	B	None---------	---	---	1.0-2.0	Perched	Nov-May	---	---	High-----	Hig
Capac-------------	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	---	High-----	Hig
14B--------------- Dixboro	B	None---------	---	---	1.0-2.0	Apparent	Nov-Apr	---	---	High-----	Moc
15B--------------- Capac	C	None---------	---	---	1.0-2.0	Apparent	Nov-May	---	---	High-----	Hig
16---------------- Napoleon	A/D	None---------	---	---	+1-1.0	Apparent	Sep-Jun	22-26	50-59	High-----	Moc

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Ri
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Unc s
					Ft			In	In		
17B*, 17C*:											
Spinks----------	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low
Metea-----------	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Moc
Coloma----------	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low
17D*:											
Spinks----------	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low
Metea-----------	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Moc
19B------------- Covert	A	None--------	---	---	2.0-3.5	Apparent	Nov-Apr	---	---	Low------	Low
20-------------- Granby	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	---	---	Moderate	Hig
21-------------- Kingsville	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jan	---	---	Moderate	Hig
22B, 22C, 22D----- Scalley	B	None--------	---	---	>6.0	---	---	---	---	Moderate	Low
23-------------- Lamson	B/D	None--------	---	---	+1-0.5	Apparent	Nov-May	---	---	High-----	Hig
24-------------- Edwards	B/D	None--------	---	---	+1-1.0	Apparent	Sep-Jun	4-12	25-30	High-----	Hig
27-------------- Granby	A/D	None--------	---	---	+1-1.0	Apparent	Nov-Jun	---	---	Moderate	Hig
28B------------- Watseka	B	None--------	---	---	1.0-2.0	Apparent	Nov-May	---	---	Moderate	Low
29B, 29C, 29D----- Coloma	A	None--------	---	---	>6.0	---	---	---	---	Low------	Low

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Ri
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Unc s
					Ft			In	In		
32 Carlisle	A/D	None	---	---	+.5-1.0	Apparent	Sep-Jun	6-18	43-54	High	Hig
36B Del Rey	C	None	---	---	1.0-2.0	Apparent	Nov-May	---	---	High	Hig
39B, 39C, 39D, 39E Boyer	B	None	---	---	>6.0	---	---	---	---	Moderate	Low
40B, 40C Tustin	B	None	---	---	>6.0	---	---	---	---	Moderate	Hig
41B Marlette	B	None	---	---	2.5-6.0	Apparent	Dec-Apr	---	---	Moderate	Low
41C, 41C2, 41D Marlette	B	None	---	---	>6.0	---	---	---	---	Moderate	Low
42B*:											
Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Mod
Marlette	B	None	---	---	2.5-6.0	Apparent	Dec-Apr	---	---	Moderate	Low
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low
42C*, 42C2*:											
Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Mod
Marlette	B	None	---	---	>6.0	---	---	---	---	Moderate	Low
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low
42D*:											
Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Mod
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low
Marlette	B	None	---	---	>6.0	---	---	---	---	Moderate	Low

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Subsidence		Potential frost action	Ri
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total		Unc s
					Ft			In	In		
42E*:											
Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Mod
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low
43B, 43C Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Mod
44B, 44C, 44D, 44E Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low
46B, 46C, 46D, 46F Perrinton	C	None	---	---	>6.0	---	---	---	---	Moderate	Hig
47B, 47C, 47D Toogood	A	None	---	---	>6.0	---	---	---	---	Low	Low
49B Toogood	A	None	---	---	2.0-3.0	Apparent	Nov-May	---	---	Low	Low
51B Thetford	A	None	---	---	1.0-2.0	Apparent	Nov-May	---	---	Moderate	Low
52 Linwood	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	---	15-40	High	Mod
53 Parkhill	B/D	None	---	---	+1-1.0	Apparent	Nov-May	---	---	High	Hig
55 Sickles	B/D	None	---	---	+1-1.0	Apparent	Dec-May	---	---	Moderate	Hig
60B, 60C, 60D Grattan	A	None	---	---	>6.0	---	---	---	---	Low	Low
62 Jebavy	A/D	None	---	---	+1-1.0	Apparent	Oct-Jun	---	---	Moderate	Hig

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Subsidence: Initial	Subsidence: Total	Potential frost action	Ri Unc s
					Ft			In	In		
65----------------- Wauseon	B/D	None---------	---	---	+1-1.0	Perched	Nov-May	---	---	High-----	Hig
70----------------- Udorthents	---	None---------	---	---	>6.0	---	---	---	---	---	
72----------------- Udipsamments	A	None---------	---	---	>6.0	---	---	---	---	Low------	Low
82----------------- Algansee	B	Occasional	Long------	Nov-May	1.0-2.0	Apparent	Nov-May	---	---	Moderate	Low
88----------------- Ceresco	B	Occasional	Brief-----	Mar-May	1.0-2.0	Apparent	Oct-May	---	---	High-----	Low
90*:											
Histosols---------	D	None---------	---	---	+1-1.0	Apparent	Jan-Dec	---	---	High-----	Hig
Aquents-----------	D	None---------	---	---	+1-1.0	Apparent	Jan-Dec	---	---	High-----	
91B, 91C, 91D, 91F-------------- Plainfield	A	None---------	---	---	>6.0	---	---	---	---	Low------	Low
92B--------------- Selfridge	B	None---------	---	---	1.0-2.0	Perched	Nov-May	---	---	High-----	Hig
93*. Pits											
94B--------------- Brems	A	None---------	---	---	2.0-3.0	Apparent	Dec-May	---	---	Low------	Low
95A--------------- Abscota	A	Occasional	Brief-----	Mar-Jun	2.5-5.0	Apparent	Dec-May	---	---	Low------	Low
96A*:											
Pipestone---------	B	None---------	---	---	0.5-1.5	Apparent	Oct-Jun	---	---	Moderate	Low

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Subsidence: Initial	Subsidence: Total	Potential frost action	Ri... Unc... s...
					Ft			In	In		
96A*:											
Kingsville	A/D	None	---	---	+1-1.0	Apparent	Nov-Jun	---	---	Moderate	Hig
97B*:											
Urban land.											
Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Moc
Marlette	B	None	---	---	>6.0	---	---	---	---	Moderate	Low
98F*:											
Plainfield	A	None	---	---	>6.0	---	---	---	---	Low	Low
Perrinton	C	None	---	---	>6.0	---	---	---	---	Moderate	Hig
111B, 111C Plainfield	A	None	---	---	>6.0	---	---	---	---	Low	Low
112B Plainfield	A	None	---	---	6.0-15	Apparent	Jan-Dec	---	---	Low	Low
115B*:											
Plainfield, banded substratum	A	None	---	---	>6.0	---	---	---	---	Low	Low
Plainfield, loamy substratum	A	None	---	---	>6.0	---	---	---	---	Low	Low
121B, 121C Grattan	A	None	---	---	>6.0	---	---	---	---	Low	Low
122B Grattan	A	None	---	---	6.0-15	Apparent	Jan-Dec	---	---	Low	Low
125B*, 125C*, 125E*:											
Grattan	A	None	---	---	>6.0	---	---	---	---	Low	Low
Spinks	A	None	---	---	>6.0	---	---	---	---	Low	Low

See footnote at end of table.

TABLE 19.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Subsidence: Initial	Subsidence: Total	Potential frost action	Ri... Unc... s...
					Ft			In	In		
130B*, 130C*, 130E*, 131B*, 131C*, 131E*:											
Grattan	A	None	---	---	>6.0	---	---	---	---	Low	Low
Coloma	A	None	---	---	>6.0	---	---	---	---	Low	Low
135B*, 135C*, 135E*, 135F*:											
Grattan	A	None	---	---	>6.0	---	---	---	---	Low	Low
Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Mod
137B*, 137C*:											
Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Mod
Tustin	B	None	---	---	>6.0	---	---	---	---	Moderate	Hig
147C*:											
Marlette	B	None	---	---	>6.0	---	---	---	---	Moderate	Low
Metea	B	None	---	---	>6.0	---	---	---	---	Moderate	Mod
181, 182 Histosols	D	None to common.	Brief to very long.	Nov-Jun	+2-1.0	Apparent	Jan-Dec	12-20	20-40	---	Hig

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 20.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Abscota	Mixed, mesic Typic Udipsamments
Adrian	Sandy or sandy-skeletal, mixed, euic, mesic Terric Medisaprists
Algansee	Mixed, mesic Aquic Udipsamments
Aquents	Aquents
Boyer	Coarse-loamy, mixed, mesic Typic Hapludalfs
*Brems	Mixed, mesic Aquic Udipsamments
Capac	Fine-loamy, mixed, mesic Aeric Ochraqualfs
Carlisle	Euic, mesic Typic Medisaprists
Ceresco	Coarse-loamy, mixed, mesic Fluvaquentic Hapludolls
Cohoctah	Coarse-loamy, mixed, mesic Fluvaquentic Haplaquolls
Coloma	Mixed, mesic Alfic Udipsamments
*Cosad	Sandy over clayey, mixed, nonacid, mesic Aquic Udorthents
Covert	Sandy, mixed, mesic Entic Haplorthods
Del Rey	Fine, illitic, mesic Aeric Ochraqualfs
*Dixboro	Coarse-loamy, mixed, mesic Aquollic Hapludalfs
Edwards	Marly, euic, mesic Limnic Medisaprists
*Glendora	Mixed, mesic Mollic Psammaquents
Granby	Sandy, mixed, mesic Typic Haplaquolls
Grattan	Sandy, mixed, mesic Entic Haplorthods
Histosols	Histosols
Jebavy	Sandy, mixed, mesic, ortstein Aeric Haplaquods
Kingsville	Mixed, mesic Mollic Psammaquents
*Lamson	Coarse-loamy, mixed, nonacid, mesic Aeric Haplaquepts
Linwood	Loamy, mixed, euic, mesic Terric Medisaprists
Marlette	Fine-loamy, mixed, mesic Glossoboric Hapludalfs
Martisco	Fine-silty, carbonatic, mesic Histic Humaquepts
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Napoleon	Dysic, mesic Typic Medihemists
*Parkhill	Fine-loamy, mixed, nonacid, mesic Mollic Haplaquepts
Perrinton	Fine, mixed, mesic Glossoboric Hapludalfs
Pipestone	Sandy, mixed, mesic Entic Haplaquods
Plainfield	Mixed, mesic Typic Udipsamments
Scalley	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Glossoboric Hapludalfs
Selfridge	Loamy, mixed, mesic Aquic Arenic Hapludalfs
Sickles	Sandy over clayey, mixed, nonacid, mesic Mollic Haplaquents
*Sparta	Sandy, mixed, mesic Entic Hapludolls
Spinks	Sandy, mixed, mesic Psammentic Hapludalfs
Thetford	Sandy, mixed, mesic Psammaquentic Hapludalfs
Toogood	Sandy, mixed, mesic Arenic Eutrochrepts
Tustin	Clayey, mixed, mesic Arenic Hapludalfs
Udipsamments	Udipsamments
Udorthents	Udorthents
Watseka	Sandy, mixed, mesic Aquic Hapludolls
*Wauseon	Coarse-loamy over clayey, mixed, mesic Typic Haplaquolls

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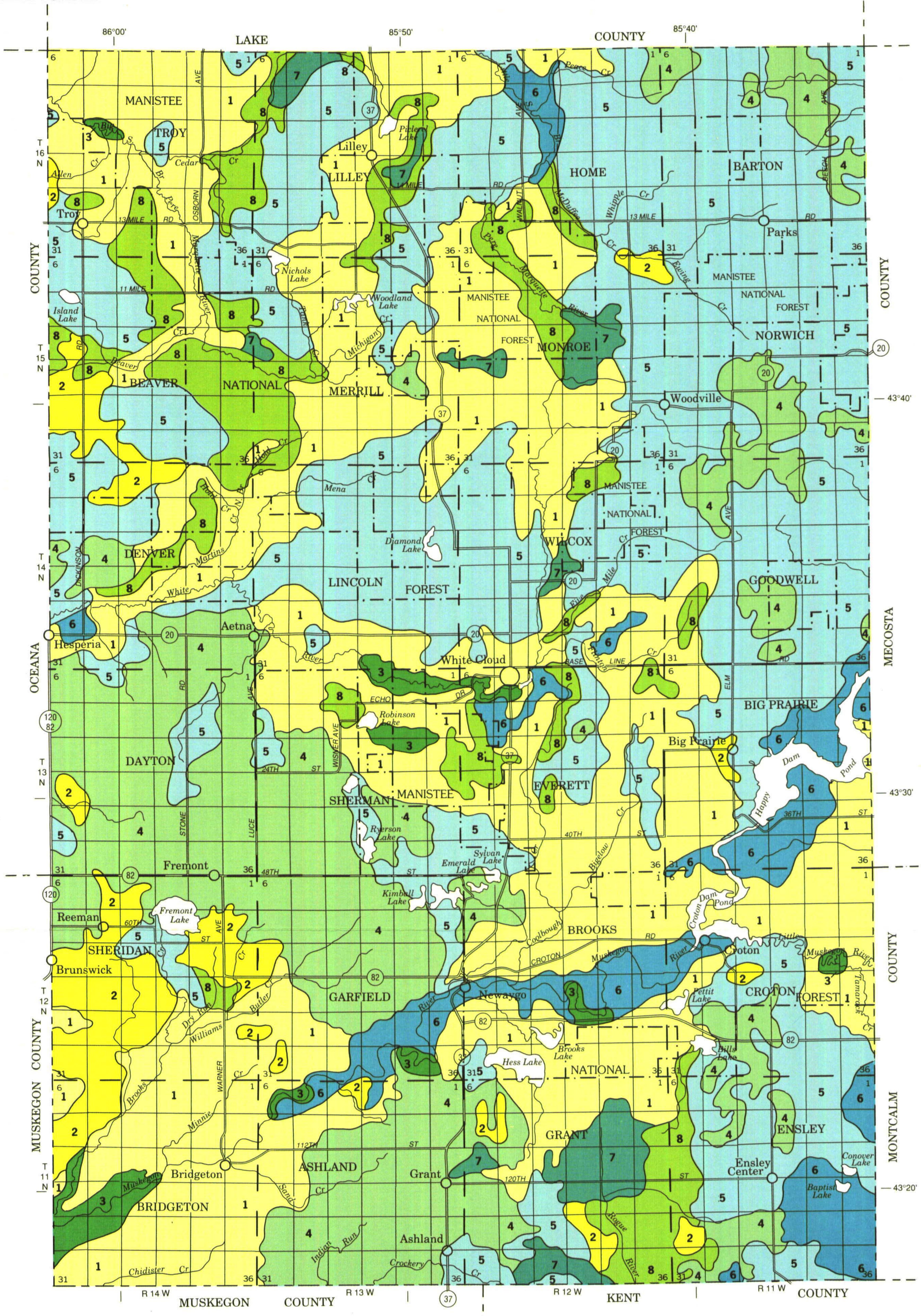


SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND*

1 Plainfield-Grattan–Brems association

2 Cosad-Del Rey-Sickles association

3 Glendora-Abscota-Algansee association

4 Marlette-Metea-Spinks association

5 Coloma-Spinks-Metea association

6 Toogood-Boyer association

7 Adrian-Carlisle-Martisco association

8 Pipestone-Covert-Kingsville association

* The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1990

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
MICHIGAN DEPARTMENT OF AGRICULTURE
MICHIGAN TECHNOLOGICAL UNIVERSITY
MICHIGAN AGRICULTURAL EXPERIMENT STATION
MICHIGAN COOPERATIVE EXTENSION SERVICE

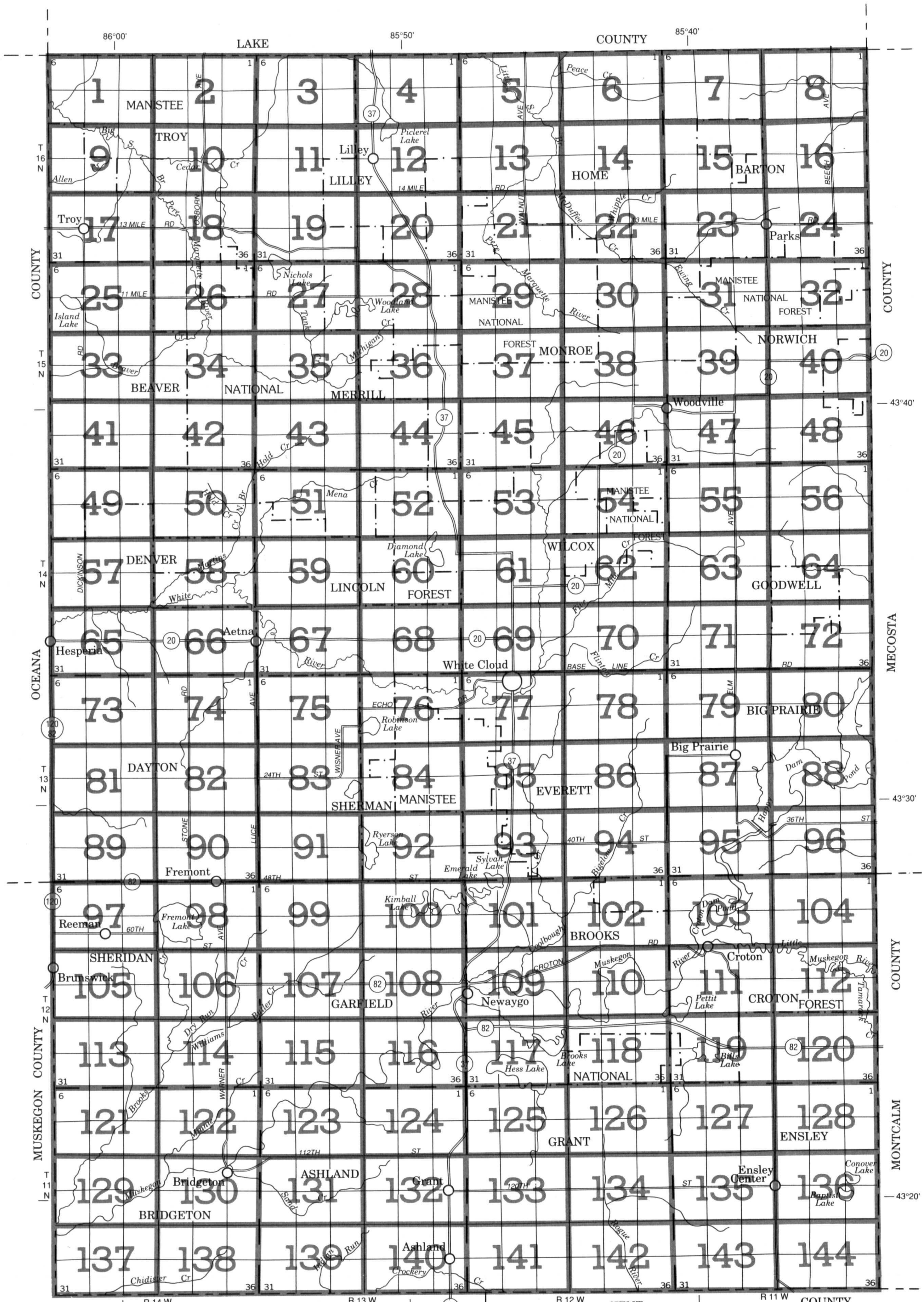
GENERAL SOIL MAP

NEWAYGO COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

NEWAYGO COUNTY, MICHIGAN

Scale 1:190,080

1 0 1 2 3 Miles

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils, higher categories, or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is moderately eroded and 3 that it is severely eroded.

2	Glendora mucky sand
3	Adrian muck
4A	Cosad loamy sand, 0 to 3 percent slopes
5B	Pipestone sand, 0 to 4 percent slopes
8	Cohoctah fine sandy loam
10B	Sparta sand, 0 to 6 percent slopes
10B3	Sparta sand, 0 to 6 percent slopes, severely eroded
10C	Sparta sand, 6 to 12 percent slopes
11	Martisco muck
13B	Selfridge-Capac complex, 0 to 5 percent slopes
14B	Dixboro loamy fine sand, 0 to 4 percent slopes
15B	Capac loam, 0 to 5 percent slopes
16	Napoleon peat
17B	Spinks-Metea-Coloma complex, 1 to 6 percent slopes
17C	Spinks-Metea-Coloma complex, 6 to 12 percent slopes
17D	Spinks-Metea complex, 12 to 25 percent slopes
19B	Covert sand, 0 to 4 percent slopes
20	Granby mucky sand
21	Kingsville mucky sand
22B	Scalley loam, 1 to 6 percent slopes
22C	Scalley loam, 6 to 12 percent slopes
22D	Scalley loam, 12 to 18 percent slopes
23	Lamson loamy fine sand
24	Edwards muck
27	Granby mucky sand, gravelly substratum
28B	Watseka loamy sand, 0 to 4 percent slopes
29B	Coloma sand, 0 to 6 percent slopes
29C	Coloma sand, 6 to 12 percent slopes
29D	Coloma sand, 12 to 30 percent slopes
32	Carlisle muck
36B	Del Rey loam, 0 to 4 percent slopes
39B	Boyer loamy sand, 0 to 6 percent slopes
39C	Boyer loamy sand, 6 to 12 percent slopes
39D	Boyer loamy sand, 12 to 18 percent slopes
39E	Boyer loamy sand, 18 to 40 percent slopes
40B	Tustin loamy sand, 1 to 6 percent slopes
40C	Tustin loamy sand, 6 to 12 percent slopes
41B	Marlette loam, moderately wet, 1 to 6 percent slopes
41C	Marlette loam, 6 to 12 percent slopes
41C2	Marlette loam, 6 to 12 percent slopes, eroded
41D	Marlette loam, 12 to 18 percent slopes
42B	Metea-MarLette-Spinks complex, 1 to 6 percent slopes
42C	Metea-Marlette-Spinks complex, 6 to 12 percent slopes
42C2	Metea-Marlette-Spinks complex, 6 to 12 percent slopes, eroded
42D	Metea-Spinks-Marlette complex, 12 to 25 percent slopes
42E	Metea-Spinks complex, 25 to 40 percent slopes
43B	Metea loamy sand, 1 to 6 percent slopes
43C	Metea loamy sand, 6 to 12 percent slopes
44B	Spinks loamy sand, 0 to 6 percent slopes
44C	Spinks loamy sand, 6 to 12 percent slopes
44D	Spinks loamy sand, 12 to 18 percent slopes
44E	Spinks loamy sand, 18 to 40 percent slopes
46B	Perrinton loam, 1 to 6 percent slopes
46C	Perrinton loam, 6 to 12 percent slopes
46D	Perrinton loam, 12 to 18 percent slopes
46F	Perrinton loam, 35 to 70 percent slopes
47B	Toogood loamy sand, 0 to 6 percent slopes
47C	Toogood loamy sand, 6 to 12 percent slopes
47D	Toogood loamy sand, 12 to 18 percent slopes
49B	Toogood loamy sand, moderately wet, 0 to 4 percent slopes
51B	Thetford loamy fine sand, 0 to 4 percent slopes
52	Linwood muck
53	Parkhill loam
55	Sickles loamy fine sand
60B	Grattan sand, 0 to 6 percent slopes
60C	Grattan sand, 6 to 18 percent slopes
60D	Grattan sand, 18 to 35 percent slopes
62	Jebavy sand
65	Wauseon loam
70	Udorthents, loamy, nearly level and gently sloping
72	Udipsamments, nearly level and gently sloping
82	Algansee loamy fine sand
88	Ceresco fine sandy loam
90	Histosols and Aquents, ponded
91B	Plainfield sand, 0 to 6 percent slopes
91C	Plainfield sand, 6 to 18 percent slopes
91D	Plainfield sand, 18 to 35 percent slopes
91F	Plainfield sand, 35 to 50 percent slopes
92B	Selfridge loamy sand, 0 to 4 percent slopes
93	Pits, sand and gravel
94B	Brems sand, 0 to 4 percent slopes
95A	Abscota loamy sand, 0 to 8 percent slopes
96A	Pipestone-Kingsville complex, 0 to 3 percent slopes
97B	Urban land-Metea-Marlette complex, 0 to 8 percent slopes
98F	Plainfield-Perrinton complex, 35 to 70 percent slopes
111B	Plainfield sand, banded substratum, 0 to 6 percent slopes
111C	Plainfield sand, banded substratum, 6 to 18 percent slopes
112B	Plainfield sand, wet substratum, 0 to 6 percent slopes
115B	Plainfield, banded substratum-Plainfield, loamy substratum, complex, 0 to 6 percent slopes
121B	Grattan sand, banded substratum, 0 to 6 percent slopes
121C	Grattan sand, banded substratum, 6 to 18 percent slopes
122B	Grattan sand, wet substratum, 0 to 6 percent slopes
125B	Grattan, banded substratum-Spinks complex, 0 to 6 percent slopes
125C	Grattan, banded substratum-Spinks complex, 6 to 18 percent slopes
125E	Grattan, banded substratum-Spinks complex, 18 to 30 percent slopes
130B	Grattan-Coloma complex, 0 to 6 percent slopes
130C	Grattan-Coloma complex, 6 to 18 percent slopes
130E	Grattan-Coloma complex, 18 to 30 percent slopes
131B	Grattan, banded substratum-Coloma complex, 0 to 6 percent slopes
131C	Grattan, banded substratum-Coloma complex, 6 to 18 percent slopes
131E	Grattan, banded substratum-Coloma complex, 18 to 30 percent slopes
135B	Grattan, banded substratum-Metea complex, 0 to 6 percent slopes
135C	Grattan, banded substratum-Metea complex, 6 to 18 percent slopes
135E	Grattan, banded substratum-Metea complex, 18 to 30 percent slopes
135F	Grattan, banded substratum-Metea complex, 30 to 60 percent slopes
137B	Metea-Tustin complex, 0 to 6 percent slopes
137C	Metea-Tustin complex, 6 to 18 percent slopes
147C	Marlette-Metea complex, 0 to 18 percent slopes
181	Histosols, dysic
182	Histosols, euic

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state, or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label) — Davis Airstrip

Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK
1 890 000 FEET

LAND DIVISION CORNER
(sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 173
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE
(normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small — water

PITS — w

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban area)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
- Double-line (label) — CANAL
- Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — 4A, 10B3

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

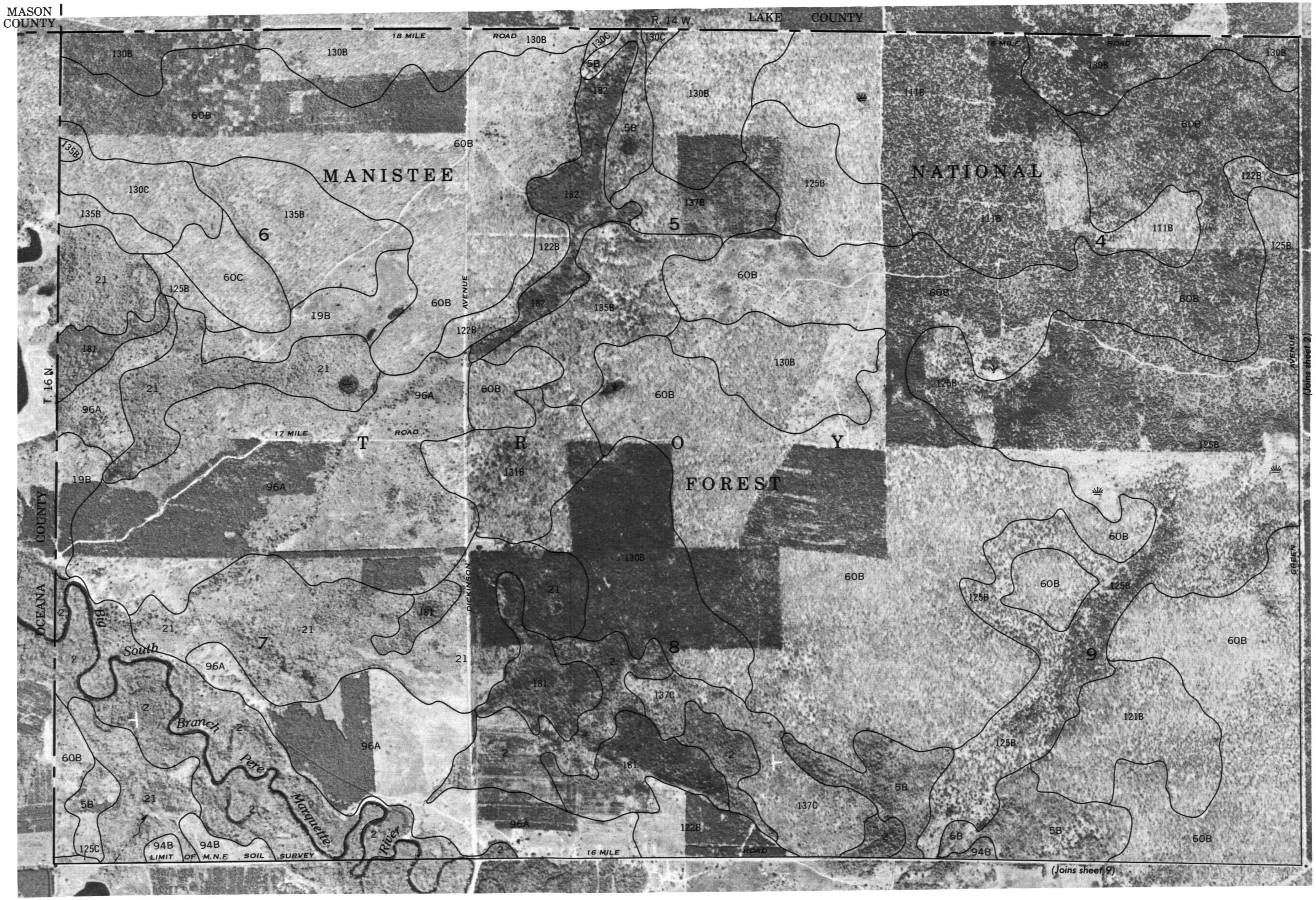
RECOMMENDED AD HOC SYMBOLS

- Loamy spot

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 1

1

N

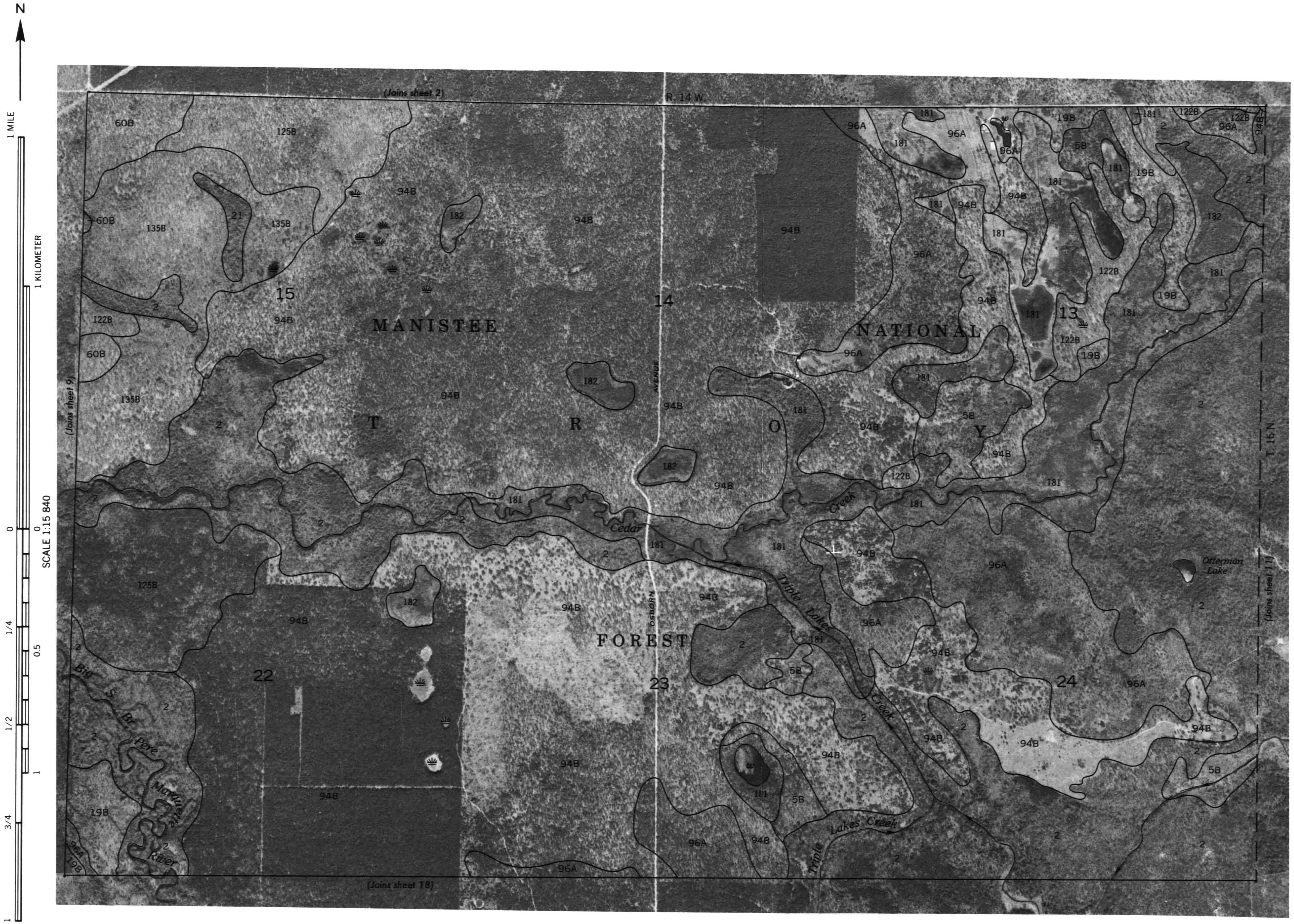


1 MILE
1 KILOMETER
SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 1

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 10



NEWAYGO COUNTY, MICHIGAN NO. 10

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 100

N

1 MILE

1 KILOMETER

SCALE 1:15 840

NEWAYGO COUNTY, MICHIGAN NO. 100

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

101

N

1 MILE

1 KILOMETER

0 1/4 1/2 3/4 1

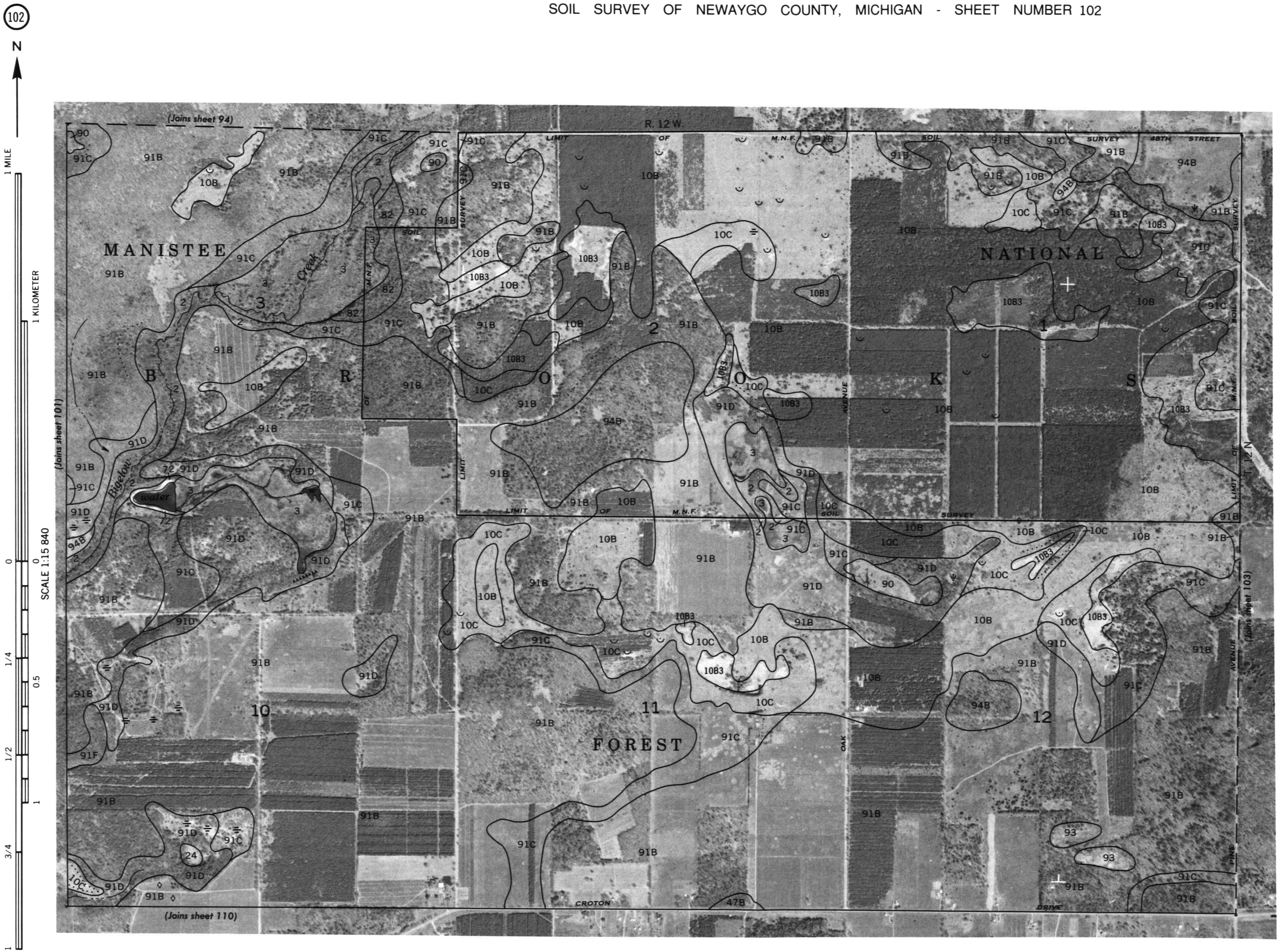
0 0.5 1

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 101

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 102



NEWAYGO COUNTY, MICHIGAN NO. 102

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

103

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 103

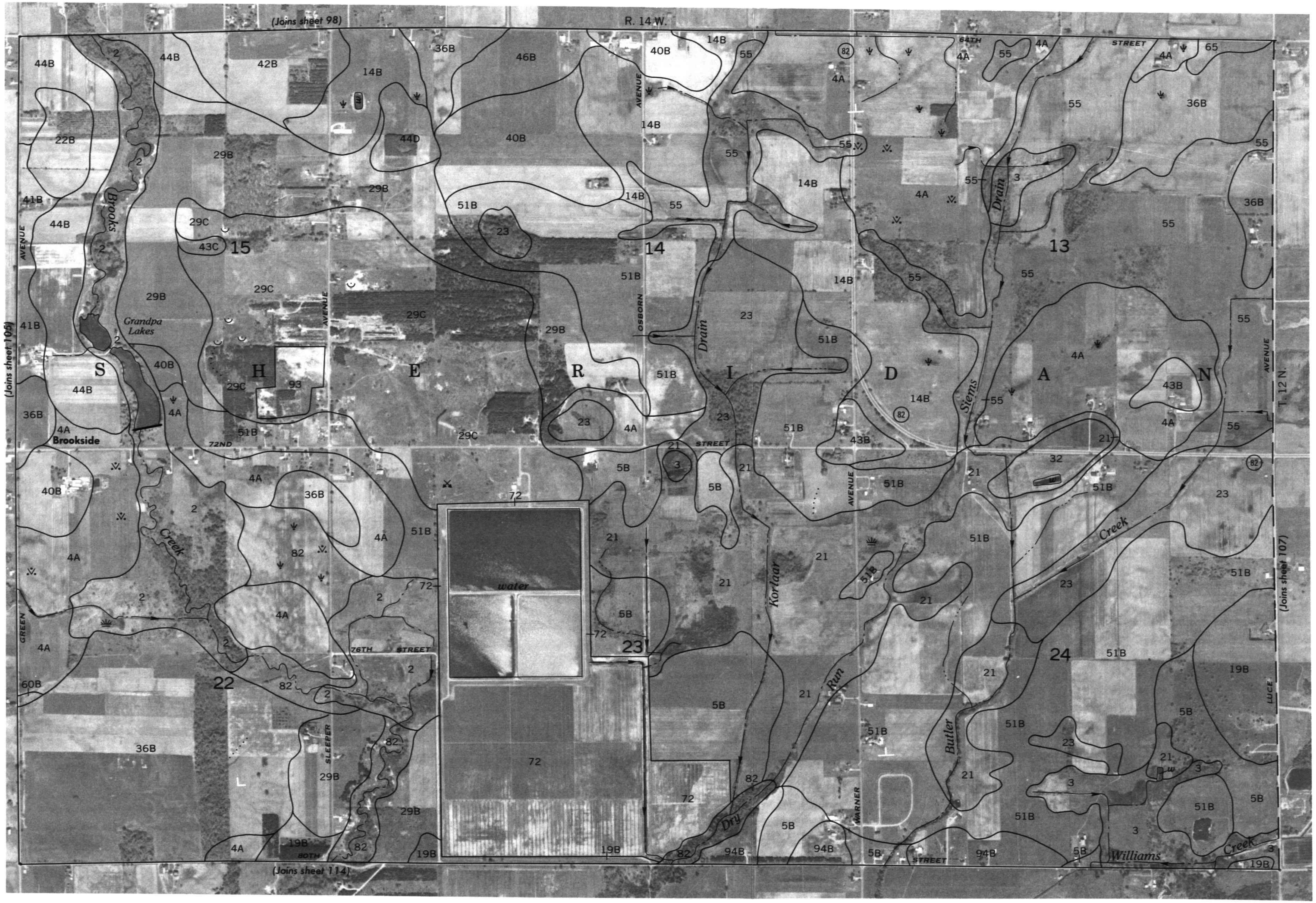
1 MILE
1 KILOMETER
0 1/4 1/2 3/4 1
0 0.5 1
SCALE 1:15 840

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 104

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 106

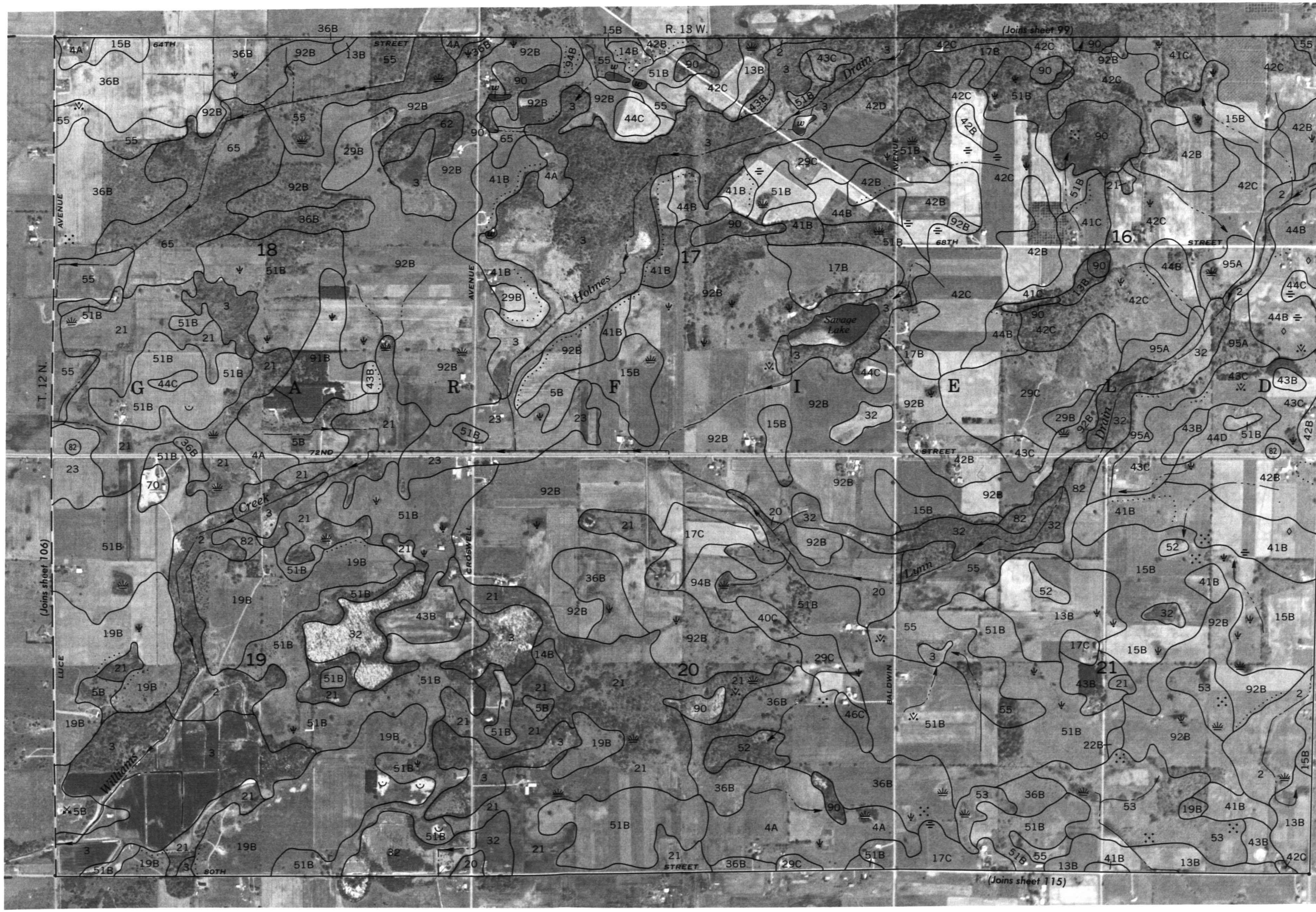


NEWAYGO COUNTY, MICHIGAN NO. 106

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

107

N

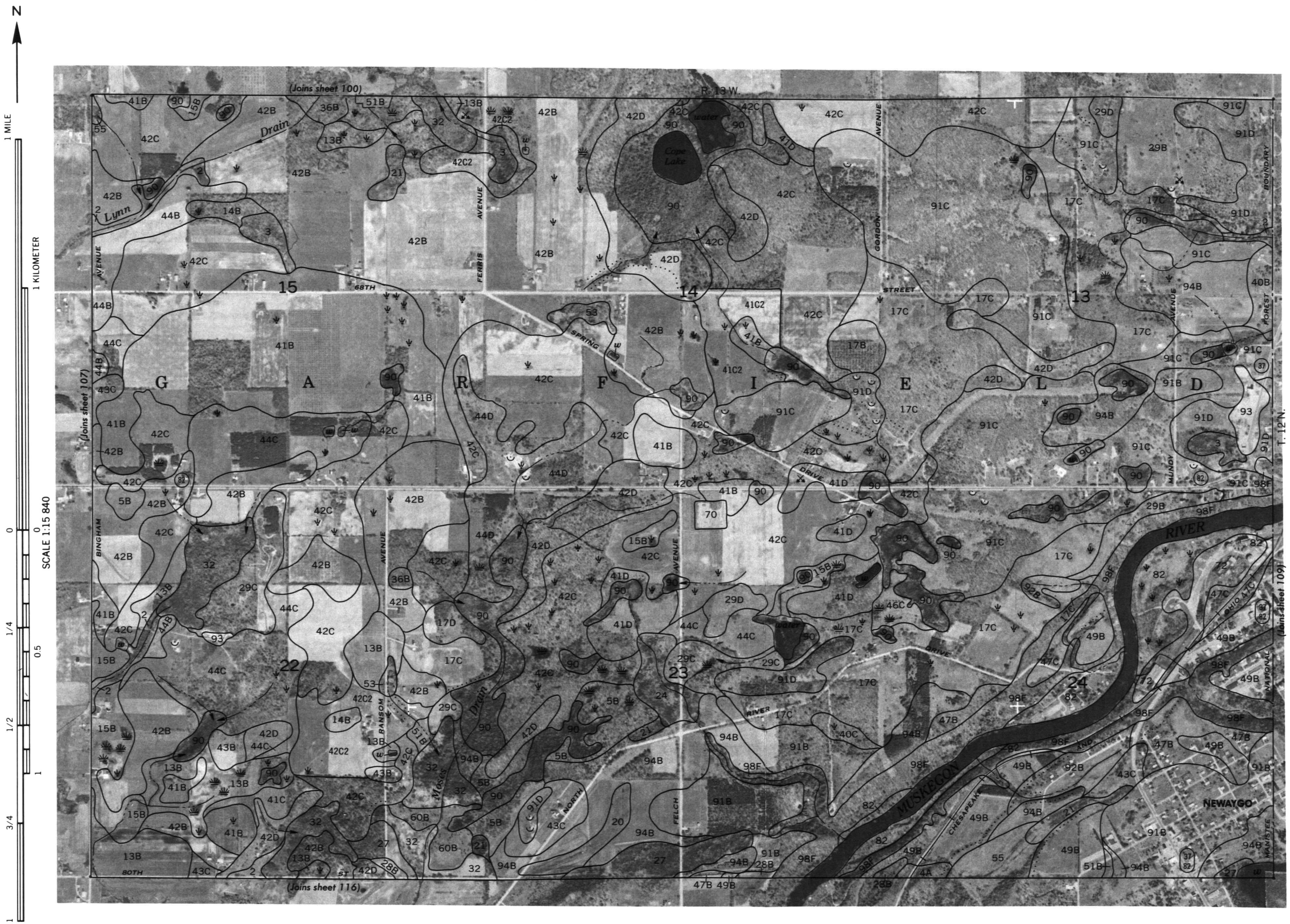


1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 107

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 108



NEWAYGO COUNTY, MICHIGAN NO. 108

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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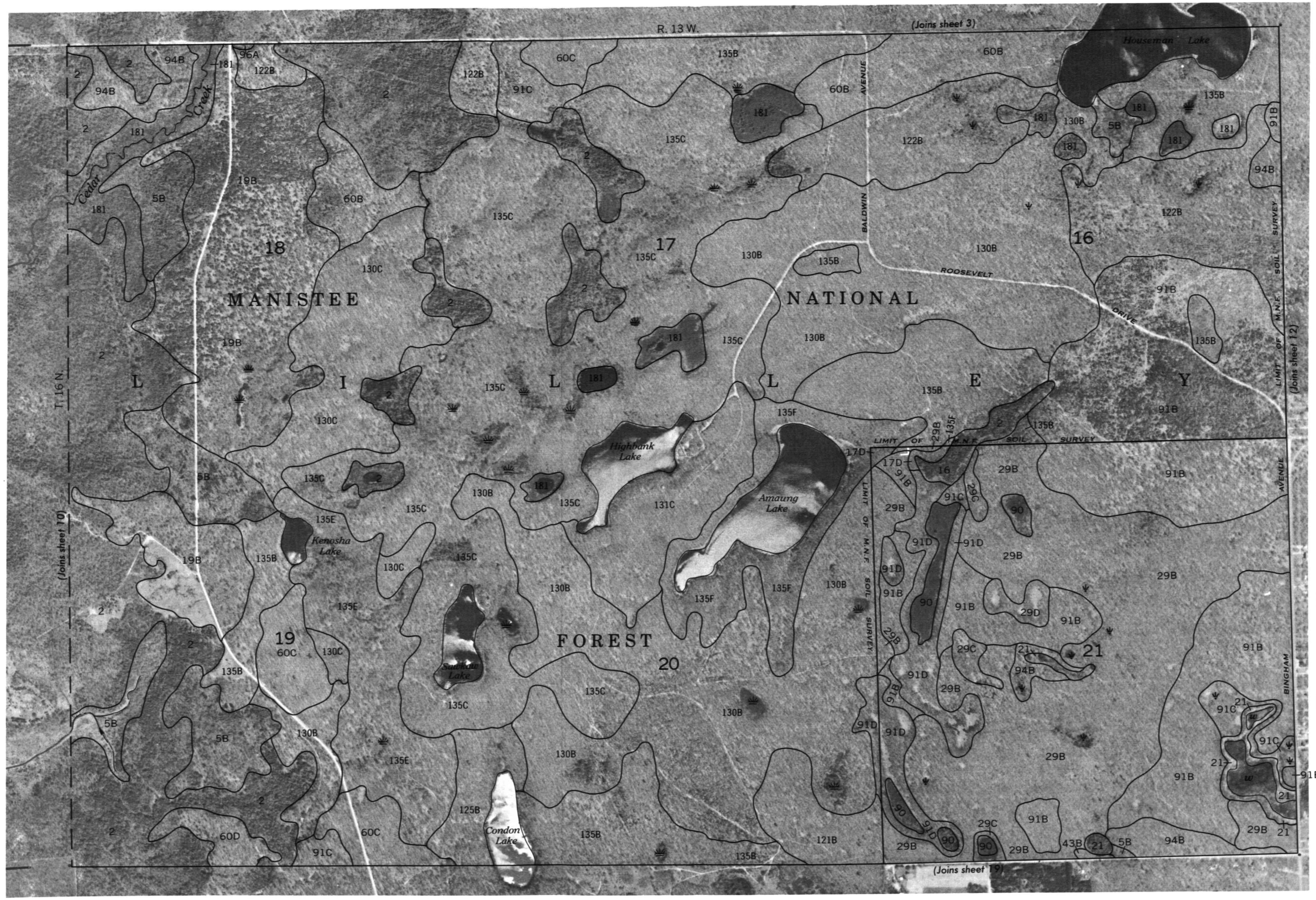
NEWAYGO COUNTY, MICHIGAN NO. 109

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 11



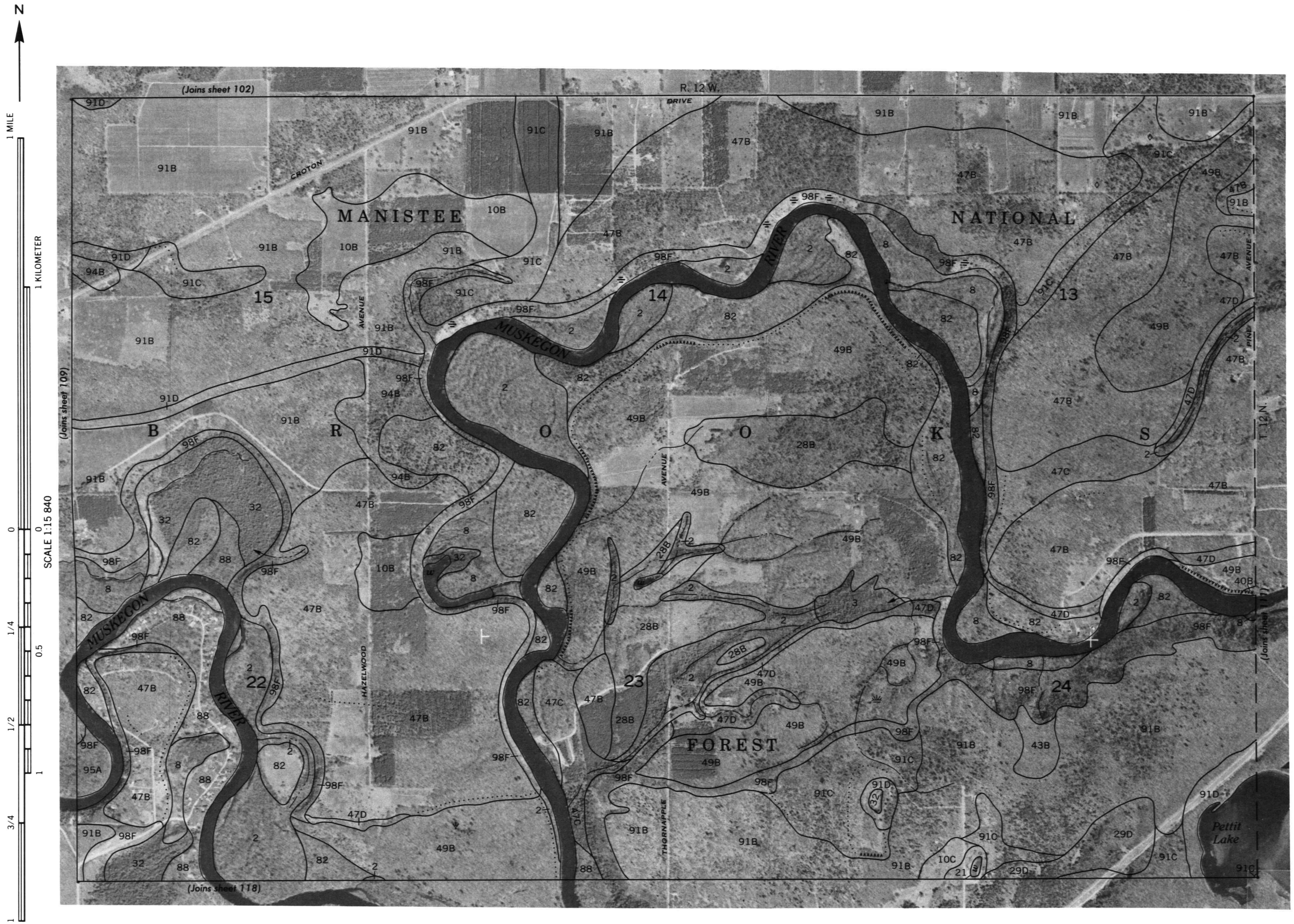
(11)

N

1 MILE

1 KILOMETER

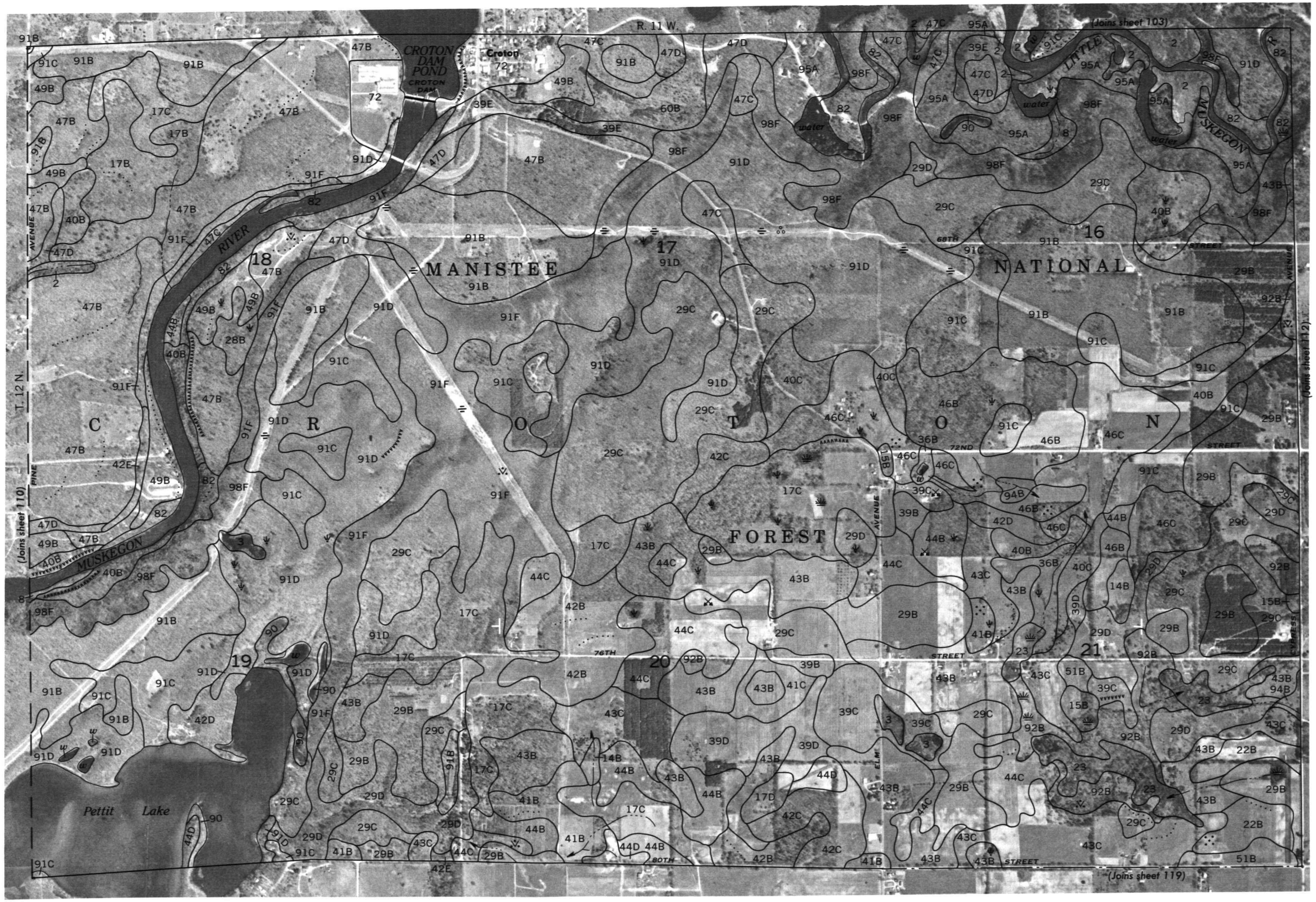
SCALE 1:15 840



NEWAYGO COUNTY, MICHIGAN NO. 110

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 111

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 112

N

1 MILE

1 KILOMETER

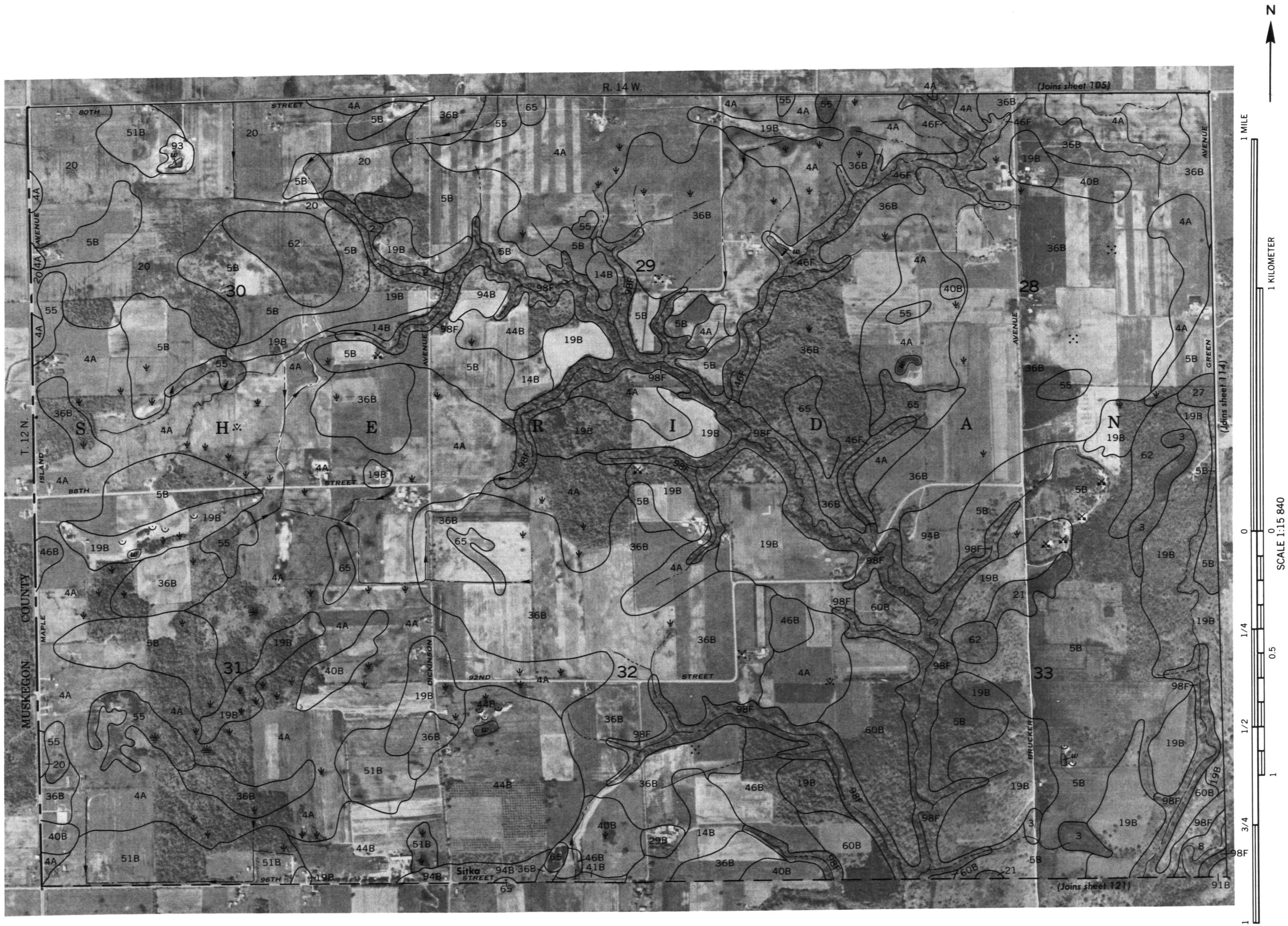
SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 112

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 113

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 114

N

1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 114

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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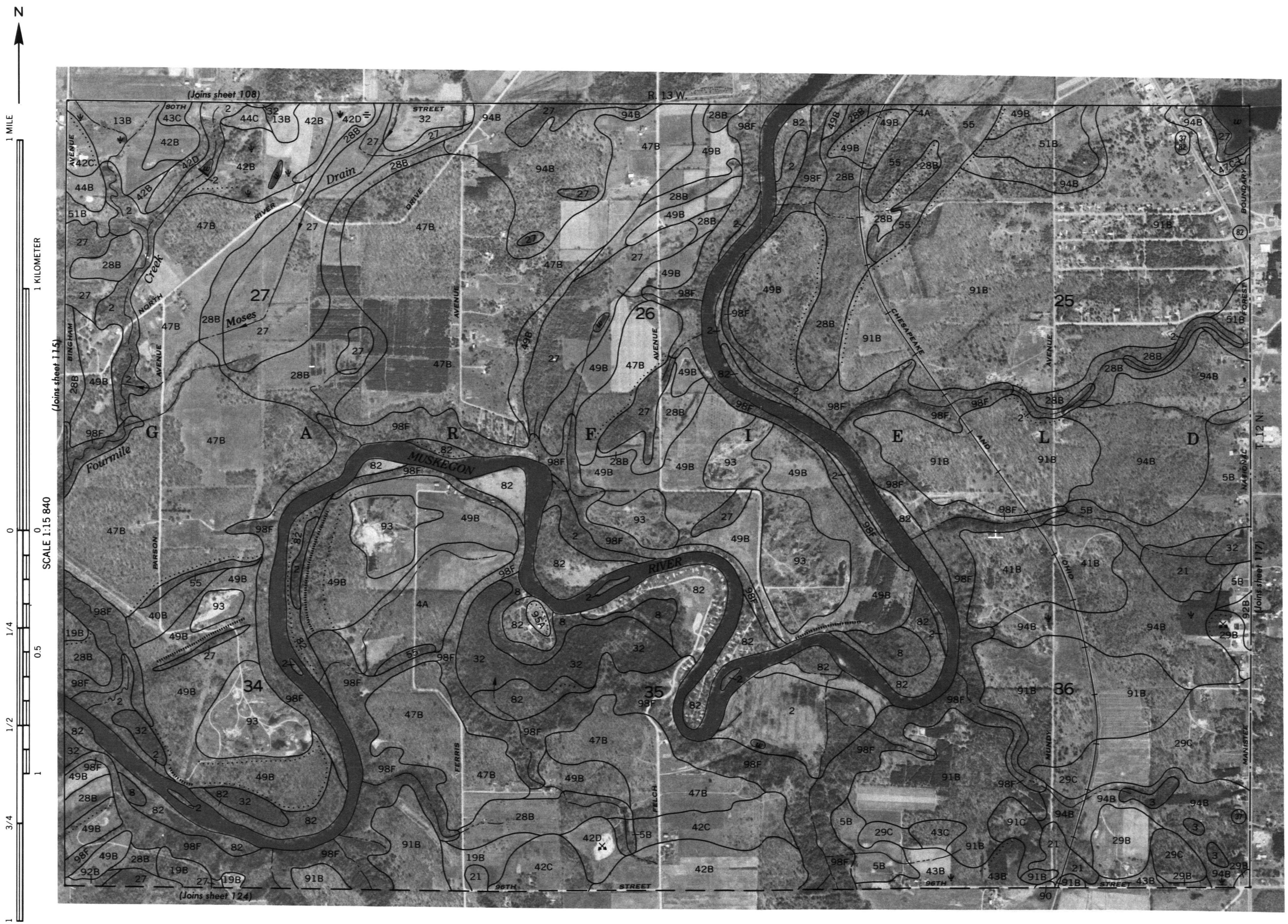
NEWAYGO COUNTY, MICHIGAN NO. 115

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 116



NEWAYGO COUNTY, MICHIGAN NO. 116

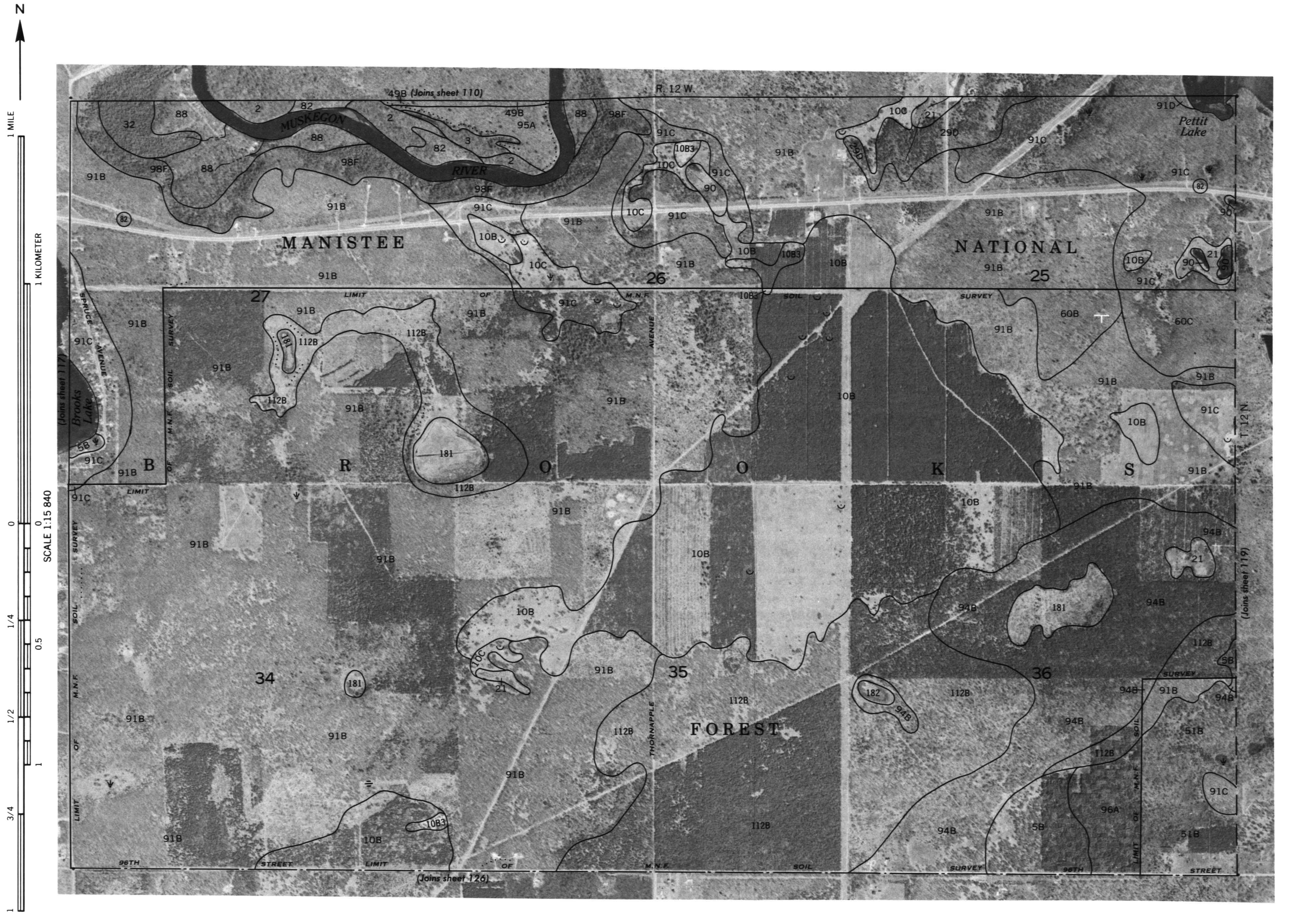
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 MILE
1 KILOMETER
SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 117

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 118



NEWAYGO COUNTY, MICHIGAN NO. 118

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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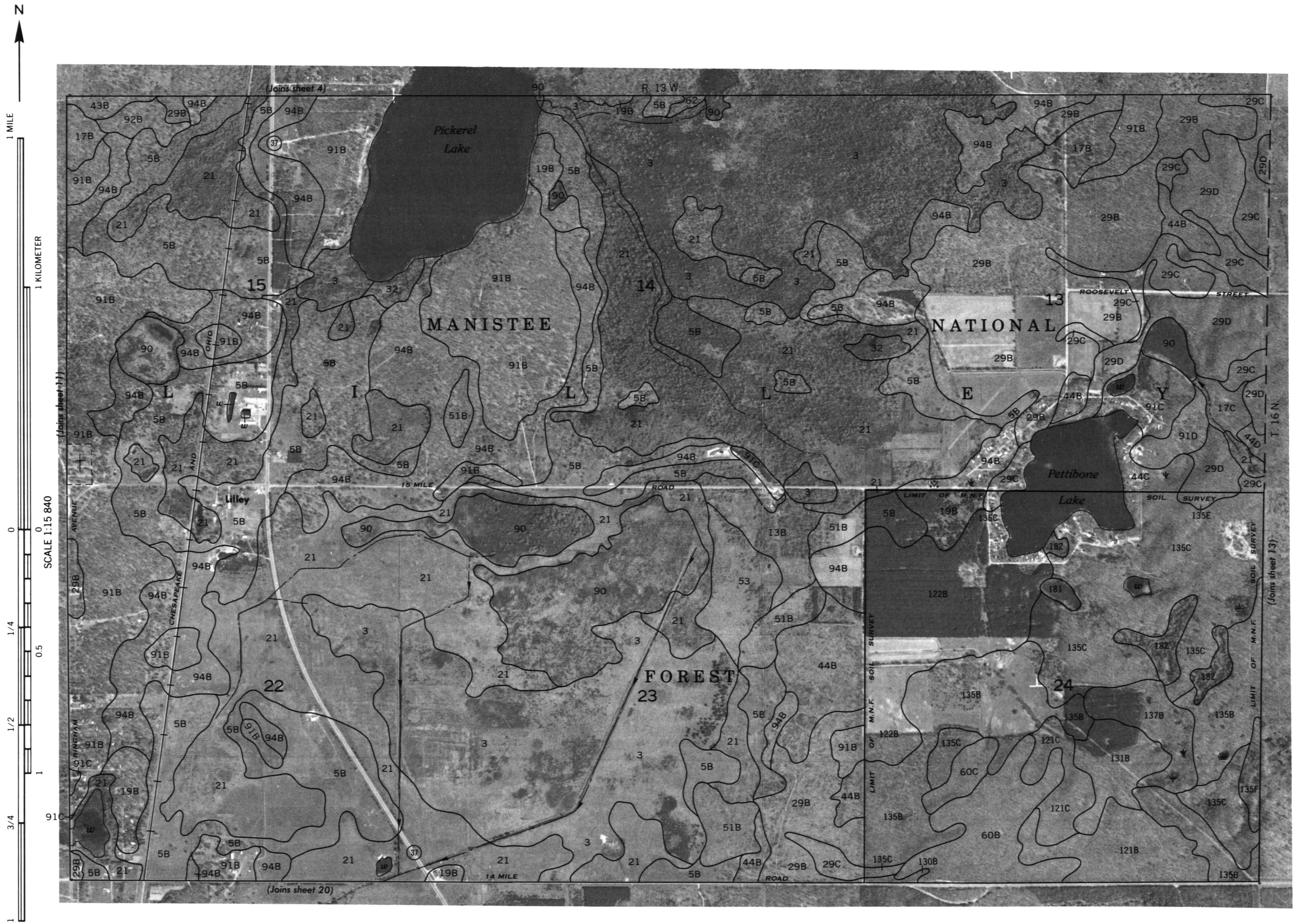
NEWAYGO COUNTY, MICHIGAN NO. 119

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 12



NEWAYGO COUNTY, MICHIGAN NO. 12

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 120

NEWAYGO COUNTY, MICHIGAN NO. 120

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

121

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

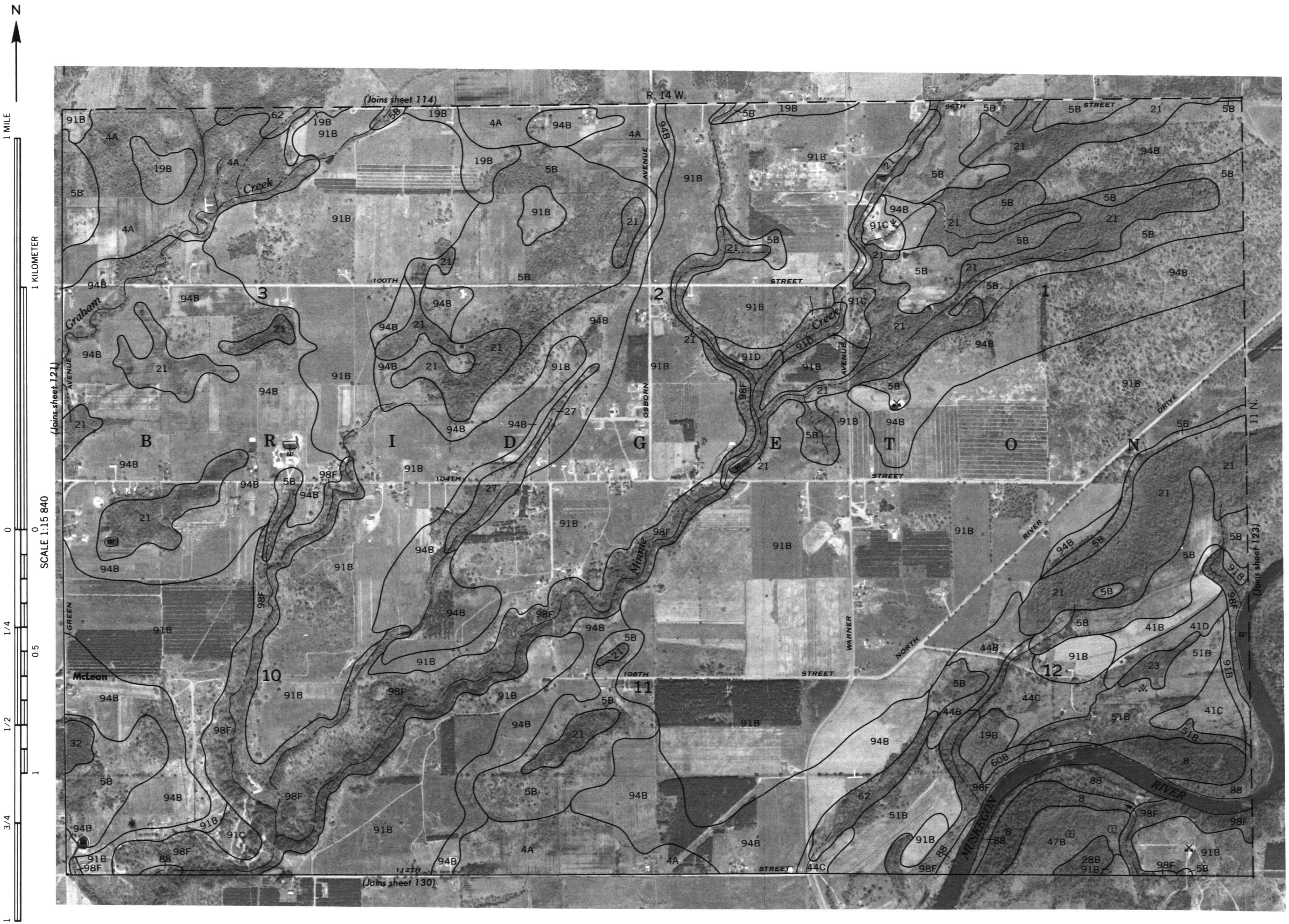
NEWAYGO COUNTY, MICHIGAN NO. 121

1 MILE
1/4
1/2
3/4
0
1

1 KILOMETER
0
0.5
1

SCALE 1:15 840

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 122



NEWAYGO COUNTY, MICHIGAN NO. 122

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

123

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 123

1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 124

N

1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 124

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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NEWAYGO COUNTY, MICHIGAN NO. 125

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 126

NEWAYGO COUNTY, MICHIGAN NO. 126

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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NEWAYGO COUNTY, MICHIGAN NO. 127

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 128

NEWAYGO COUNTY, MICHIGAN NO. 128

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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NEWAYGO COUNTY, MICHIGAN NO. 129

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 13

N

1 MILE

1 KILOMETER

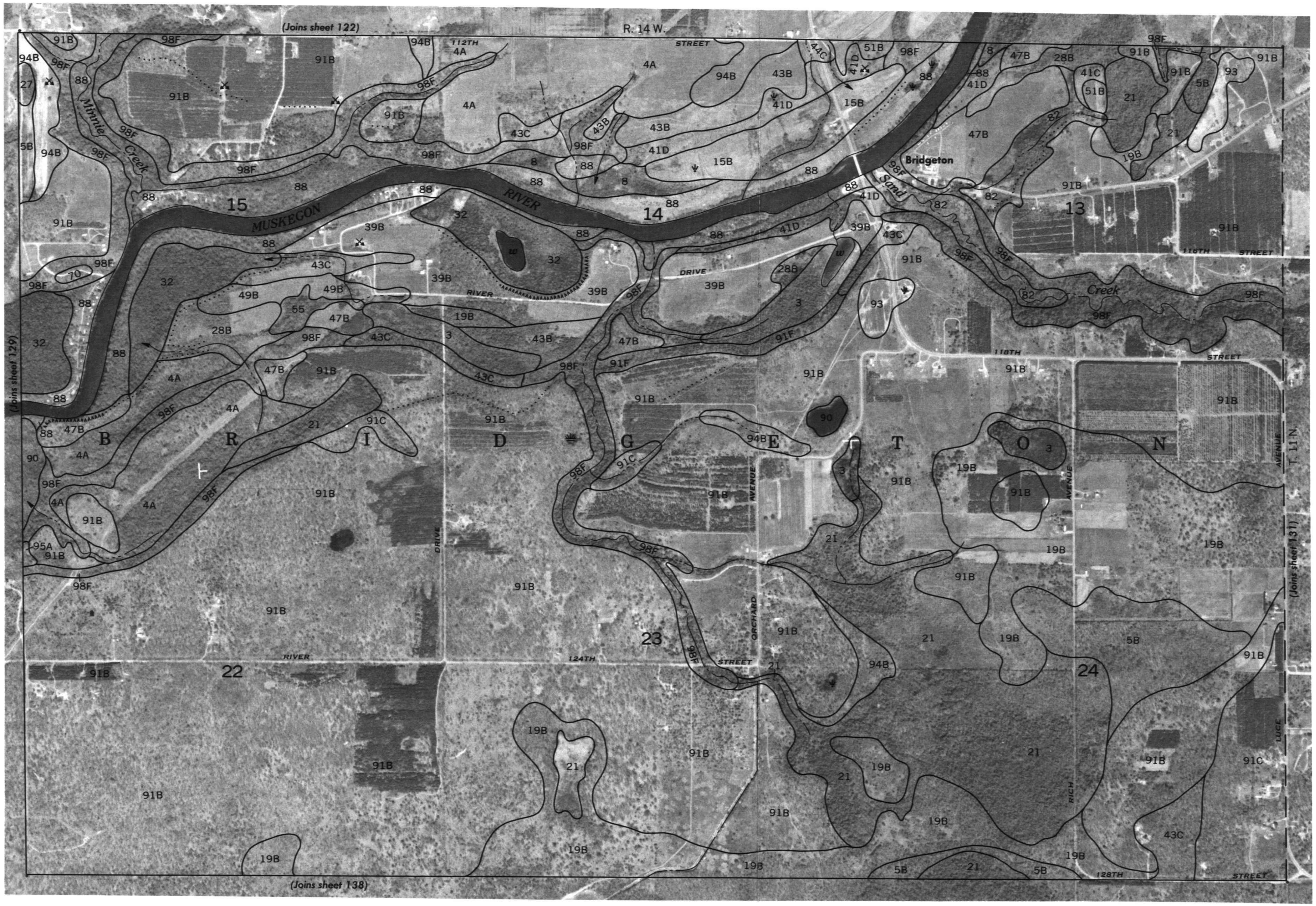
0 0 SCALE 1:15 840

1/4 0.5

1/2 1

3/4

1



NEWAYGO COUNTY, MICHIGAN NO. 130

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

131

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 131

1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

N

1 MILE

1 KILOMETER

SCALE 1:15 840

NEWAYGO COUNTY, MICHIGAN NO. 132

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

133

N

1 MILE

1 KILOMETER

0 1/4 1/2 3/4 1

0 0.5 1

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 133

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 134

NEWAYGO COUNTY, MICHIGAN NO. 134

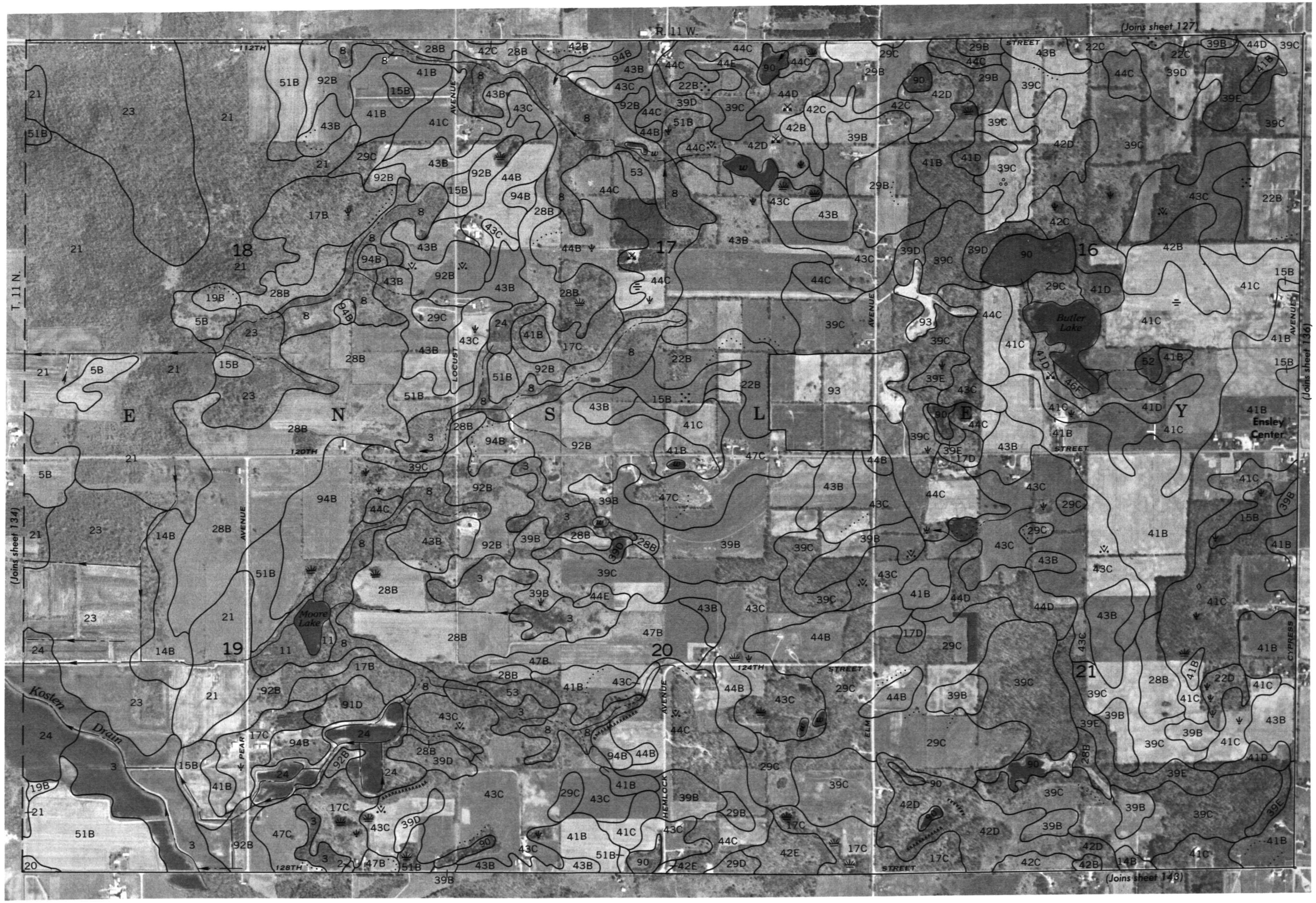
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

135

N

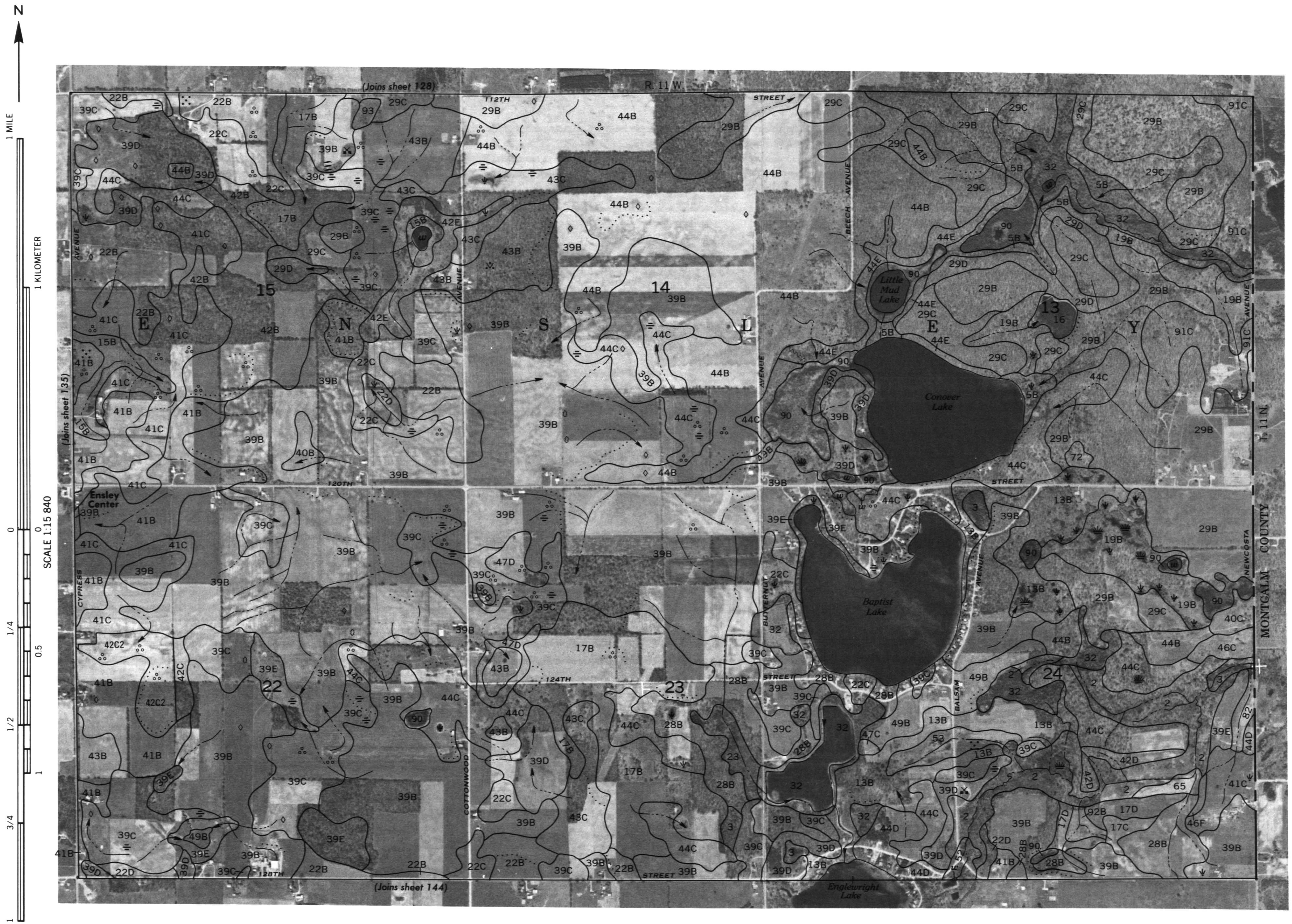
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 135



1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0
0.5
1
SCALE 1:15 840

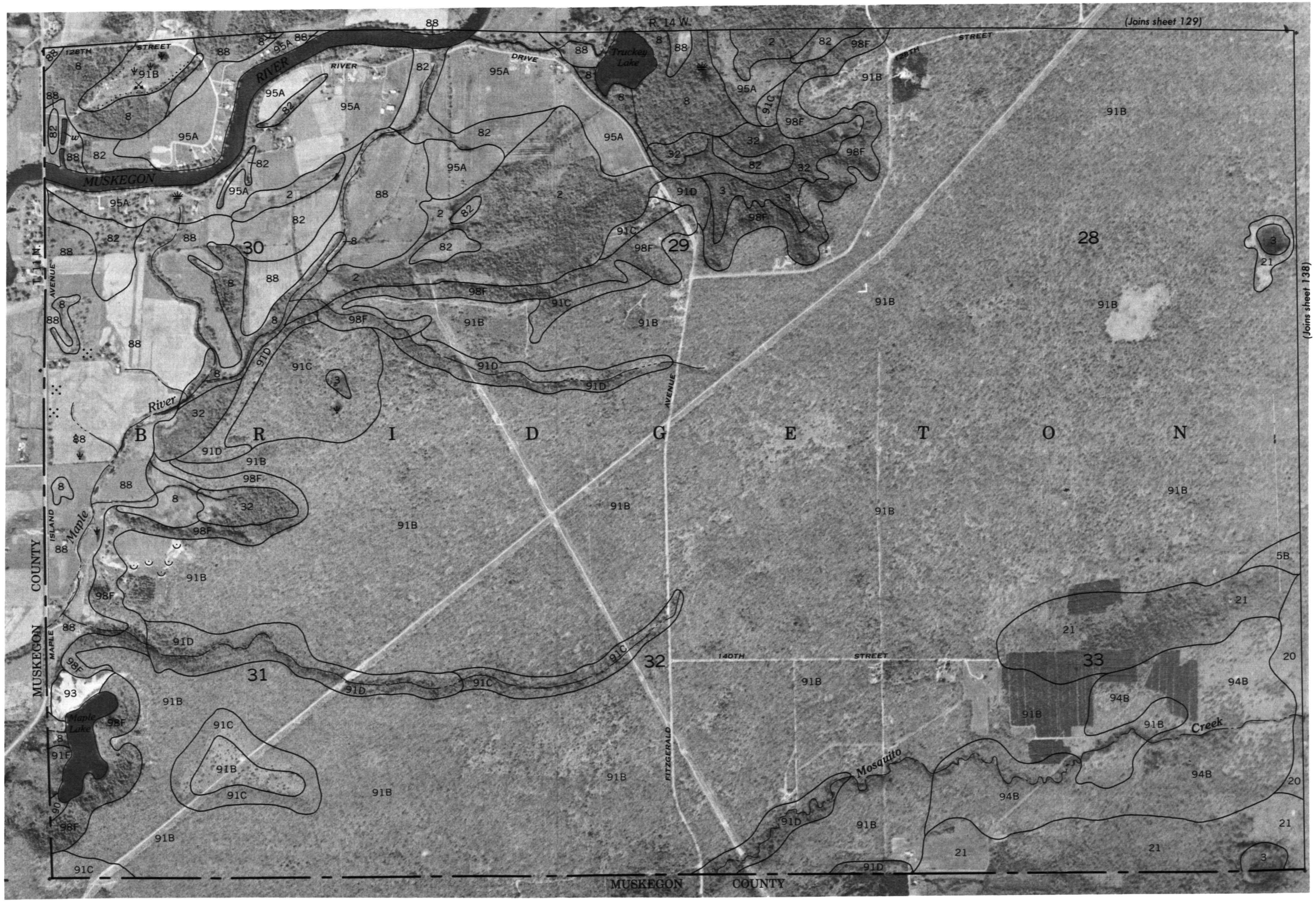
SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 136



NEWAYGO COUNTY, MICHIGAN NO. 136
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 137



N

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 138

NEWAYGO COUNTY, MICHIGAN NO. 138

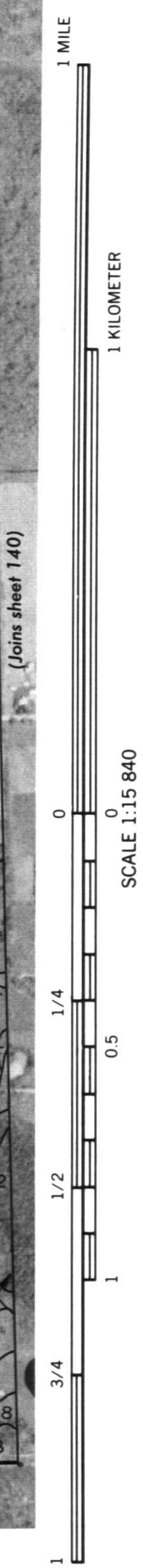
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

139

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 139



SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 14

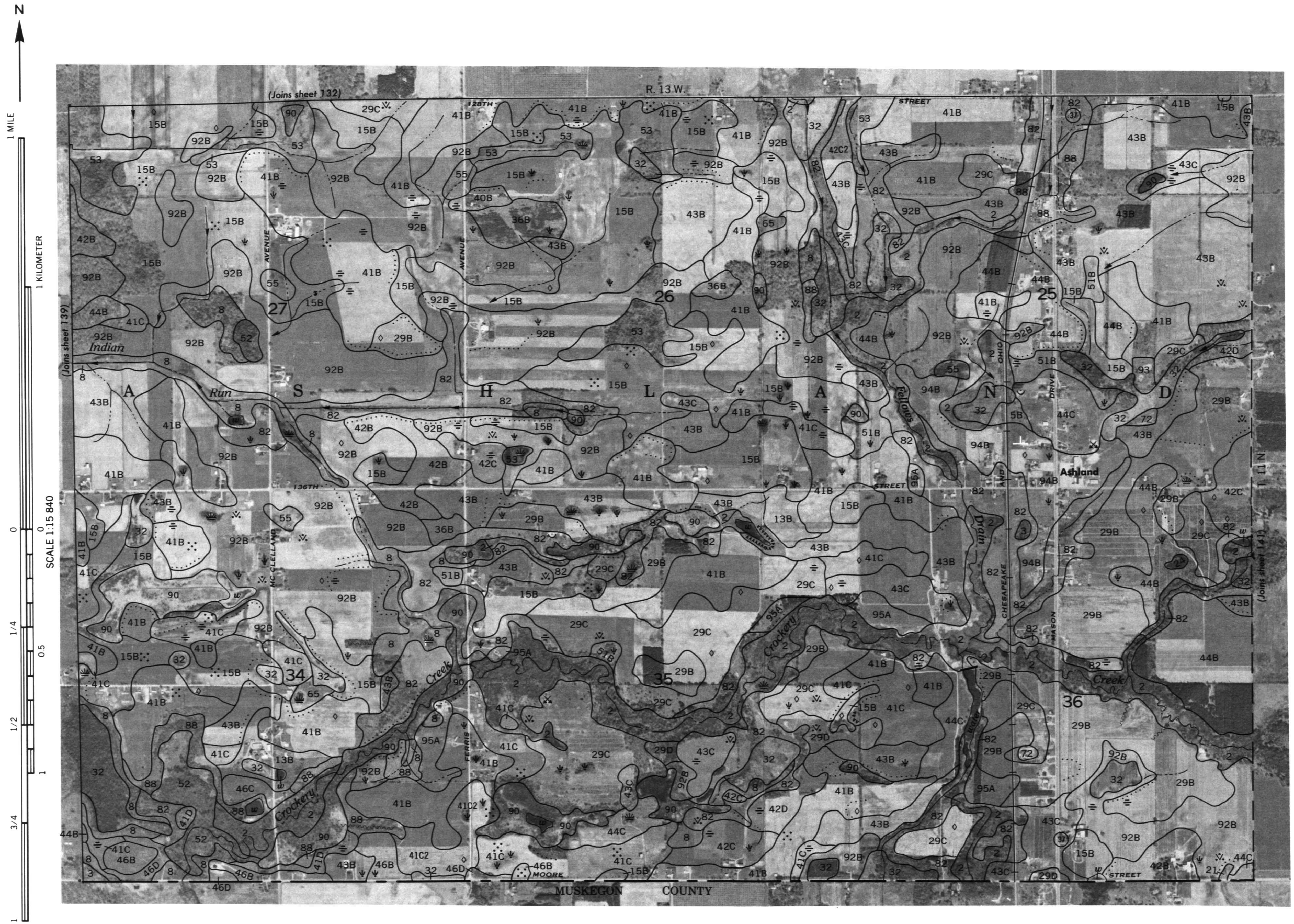
N

1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 14

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 140



NEWAYGO COUNTY, MICHIGAN NO. 140

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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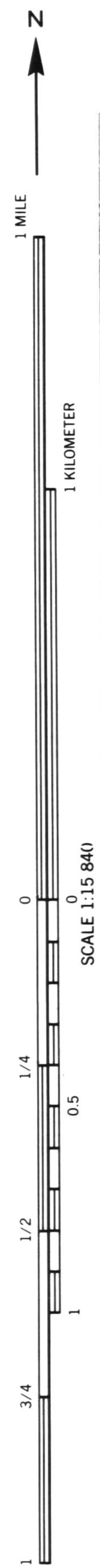
NEWAYGO COUNTY, MICHIGAN NO. 141

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 142



NEWAYGO COUNTY, MICHIGAN NO. 142

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

143

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 143

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 144

NEWAYGO COUNTY, MICHIGAN NO. 144

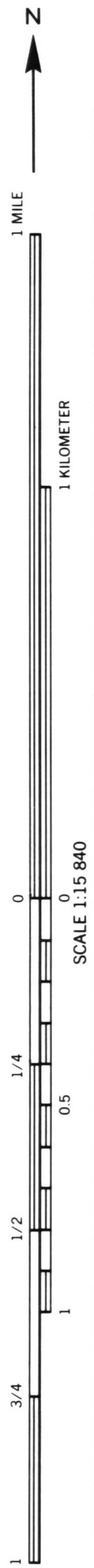
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

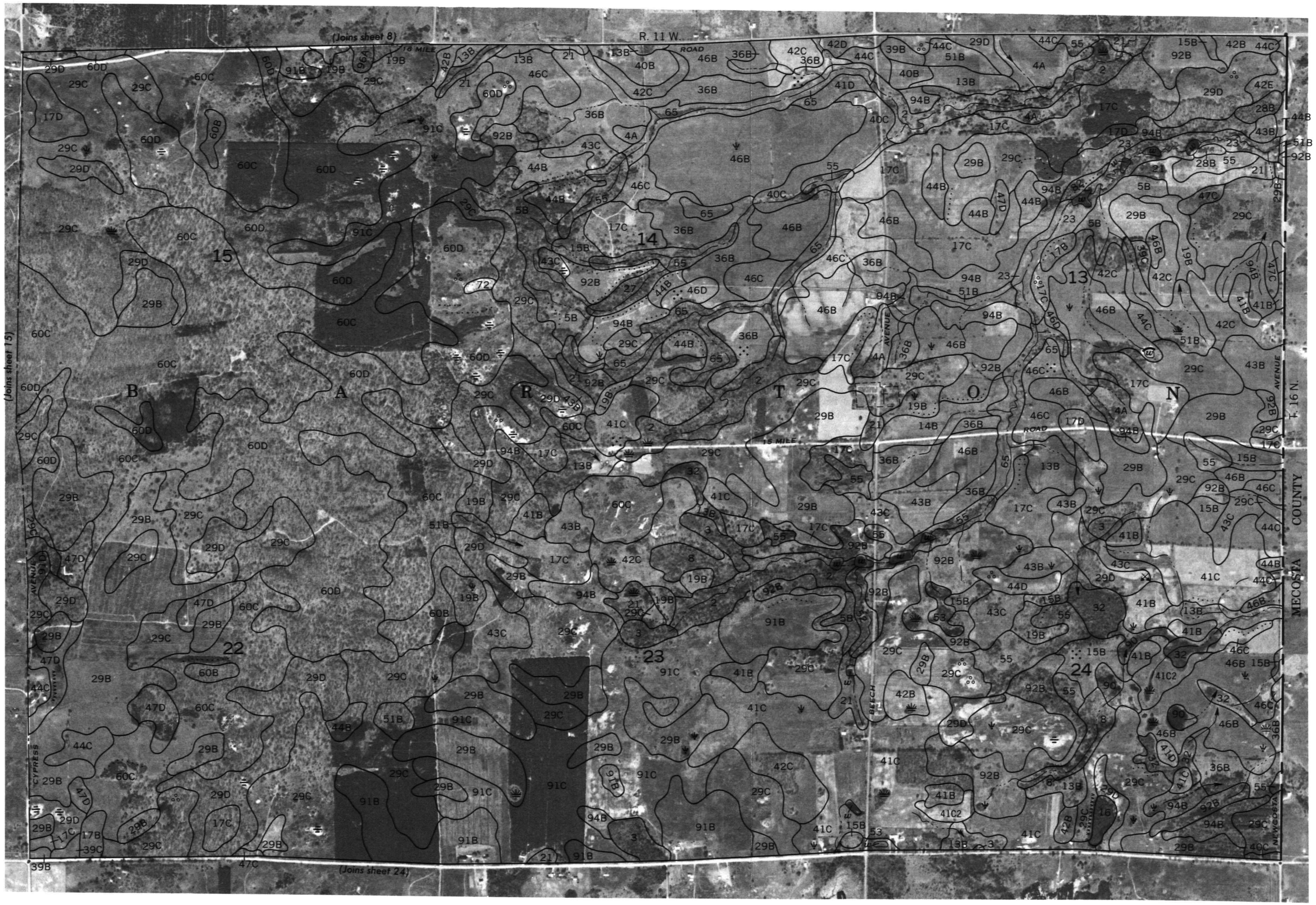
SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 15

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 15

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 16





NEWAYGO COUNTY, MICHIGAN NO. 16

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

17

N

1 MILE

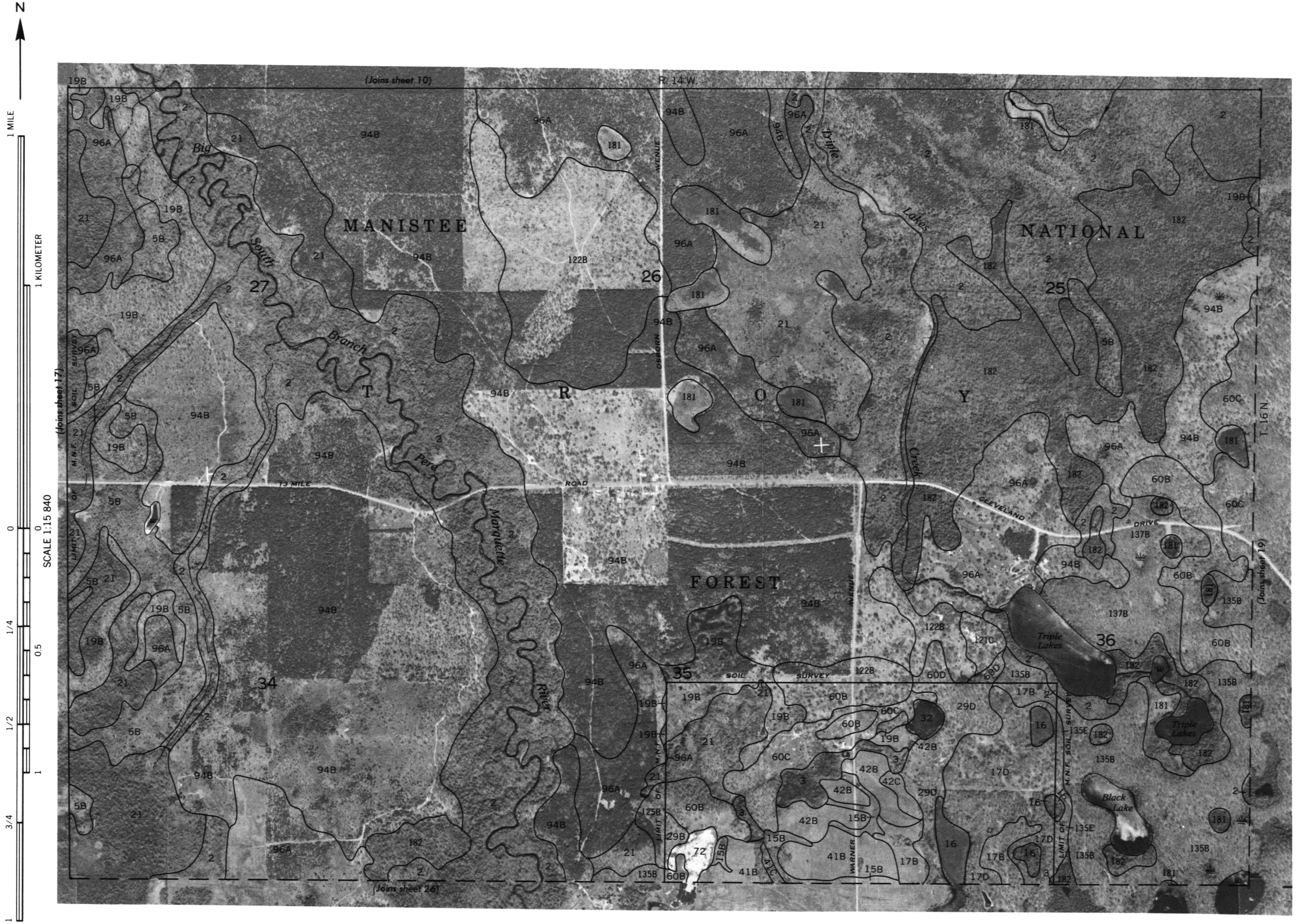
1 KILOMETER

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 17

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 18



NEWAYGO COUNTY, MICHIGAN NO. 18

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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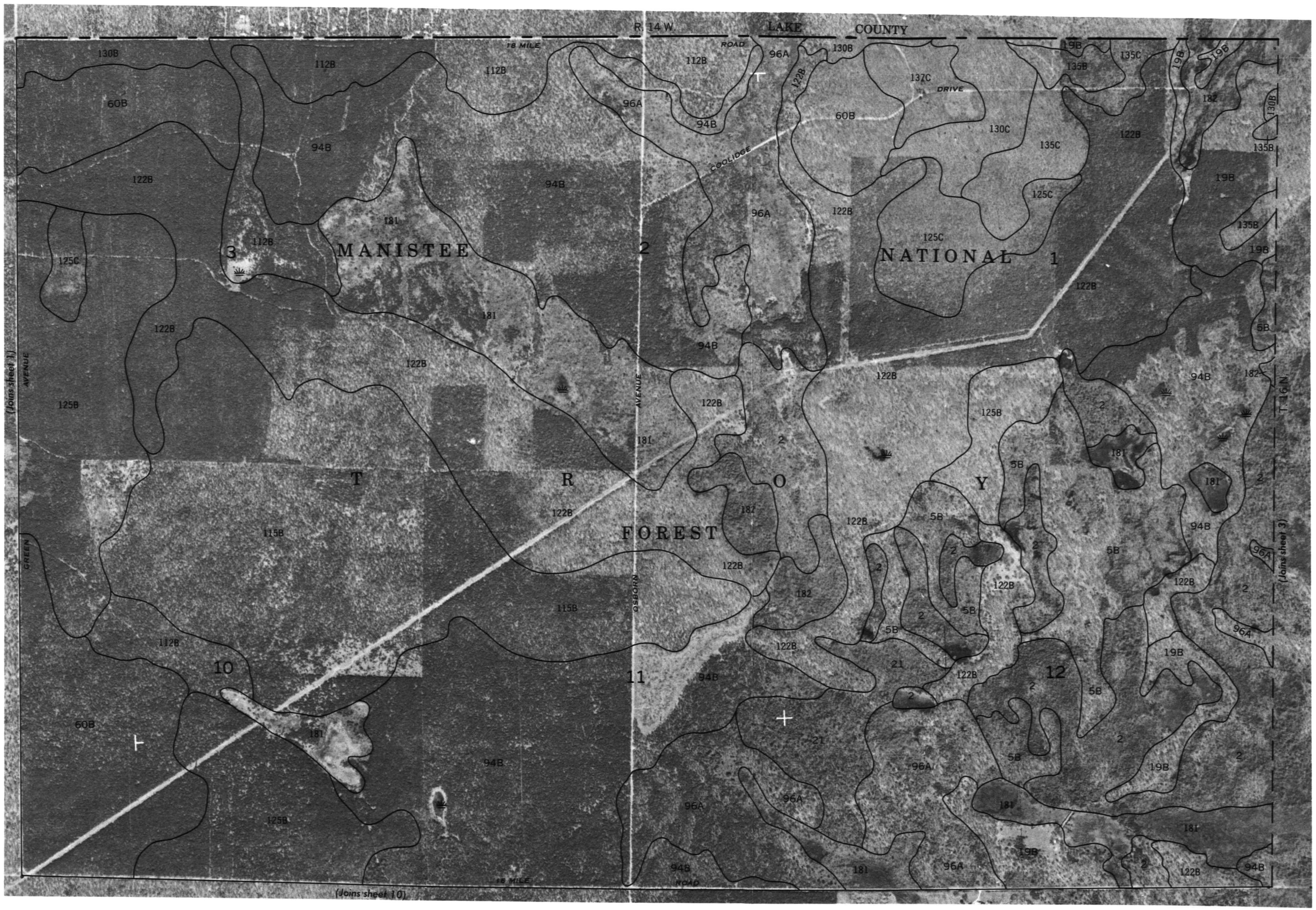
NEWAYGO COUNTY, MICHIGAN NO. 19

② N

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 2

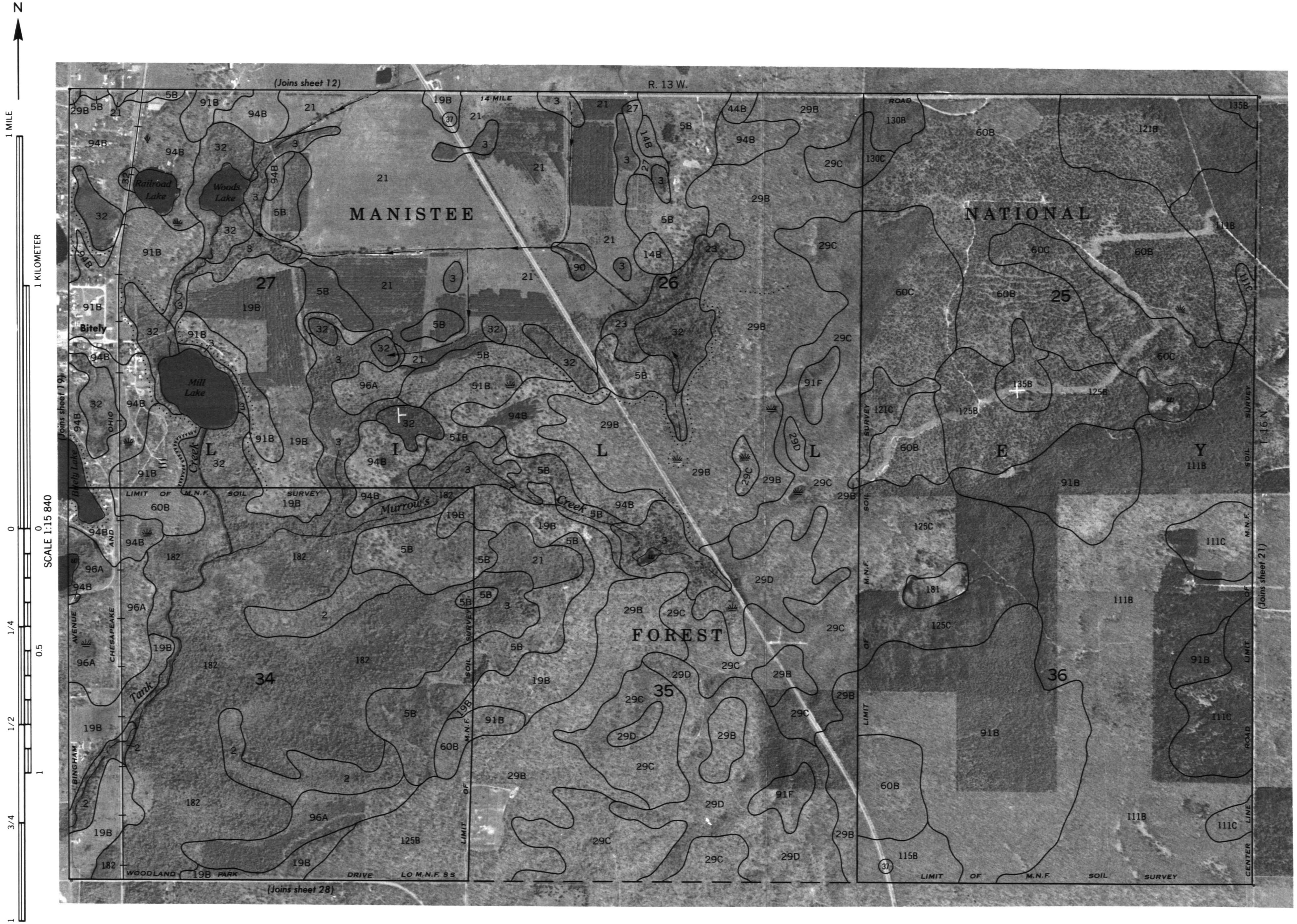


1 MILE
1 KILOMETER
SCALE 1:15 840

NEWAYGO COUNTY, MICHIGAN NO. 2

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 20



NEWAYGO COUNTY, MICHIGAN NO. 20

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

21

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 21

N

SCALE 1:15 840

1 MILE

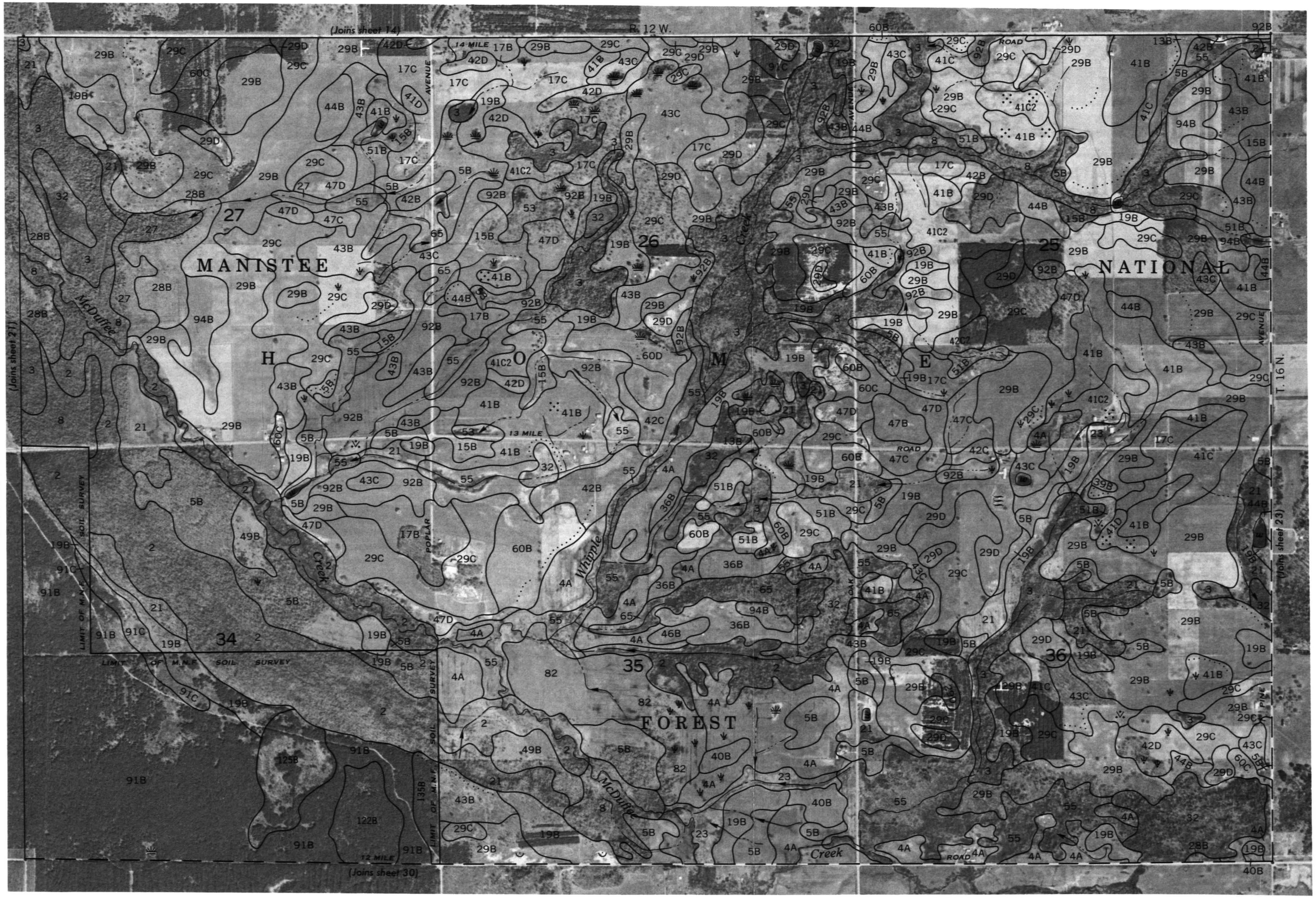
1 KILOMETER

0 1/4 1/2 3/4 1

0 0.5 1

N

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 22



1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 22

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

23

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 23

1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 24

N

1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 24

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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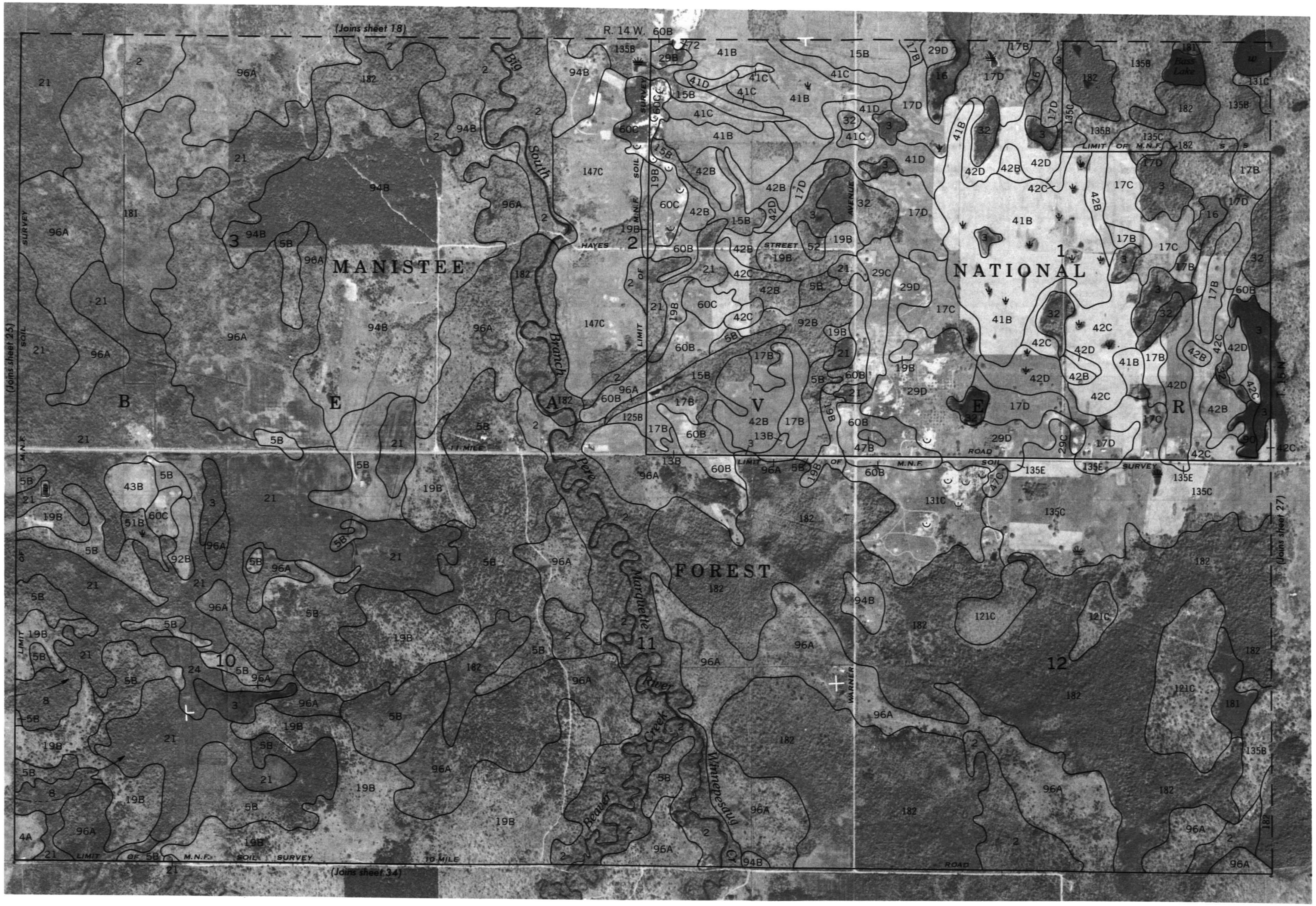
NEWAYGO COUNTY, MICHIGAN NO. 25

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 26

N

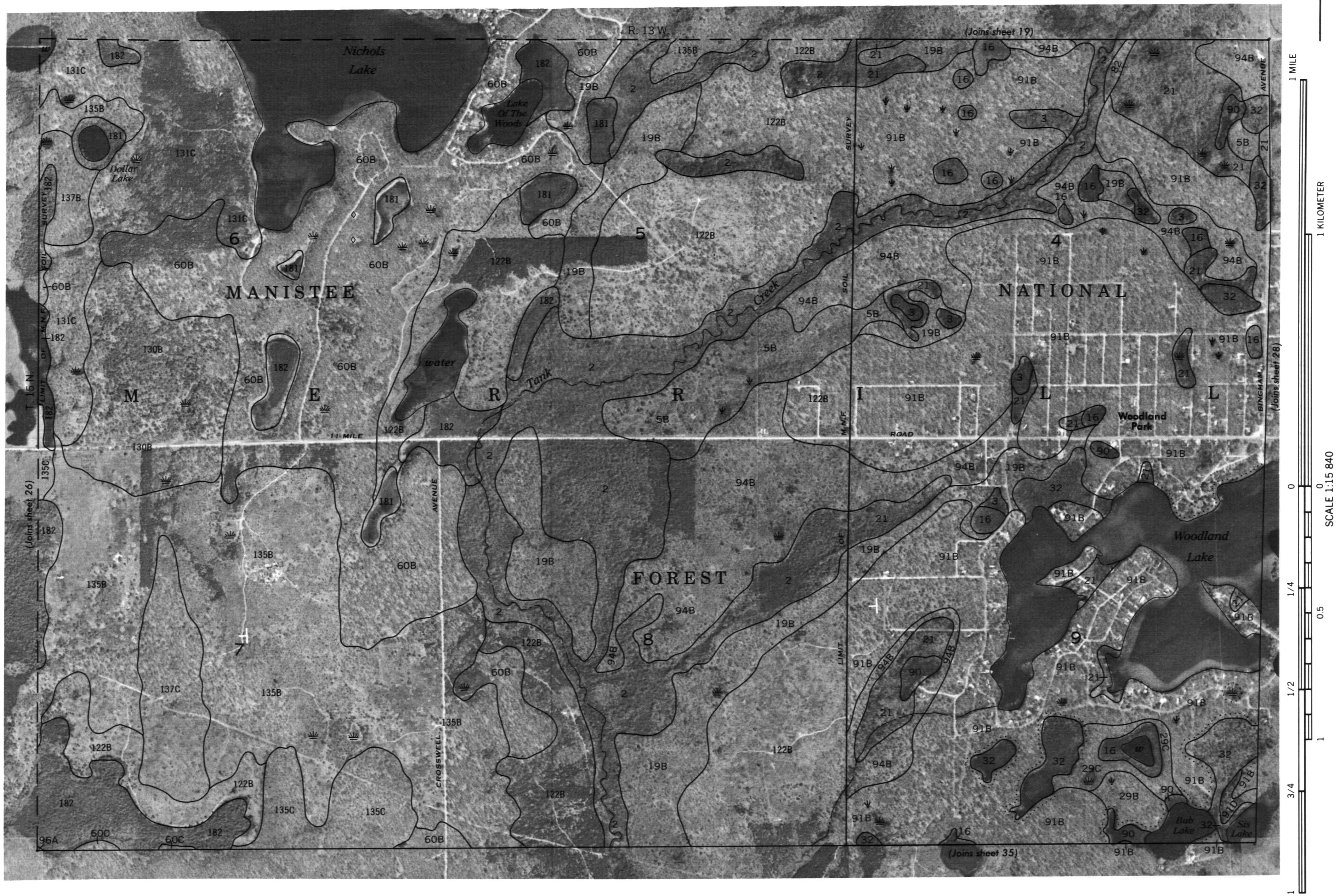


1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 26

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 27

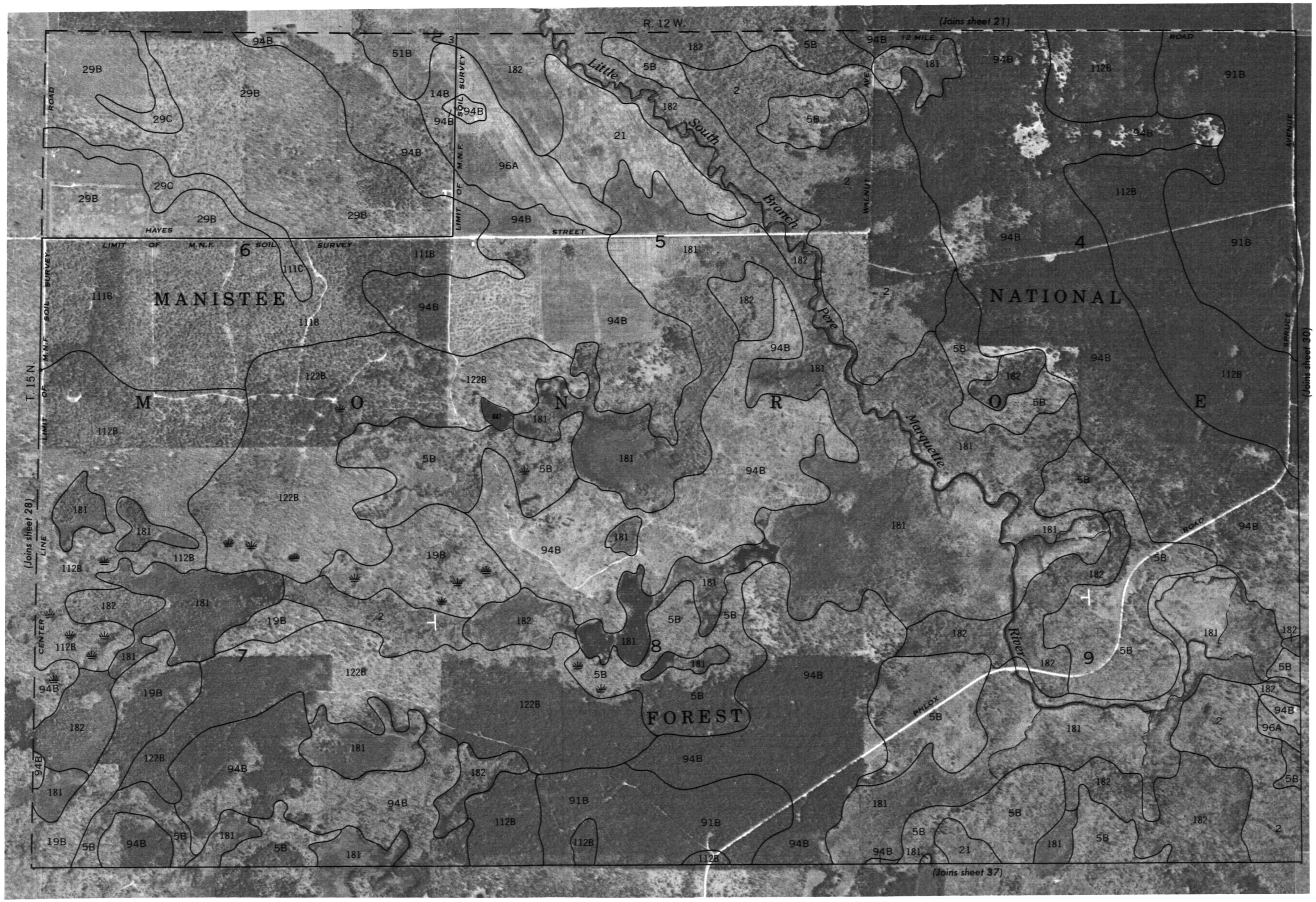
SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 28

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 28

29

N



1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

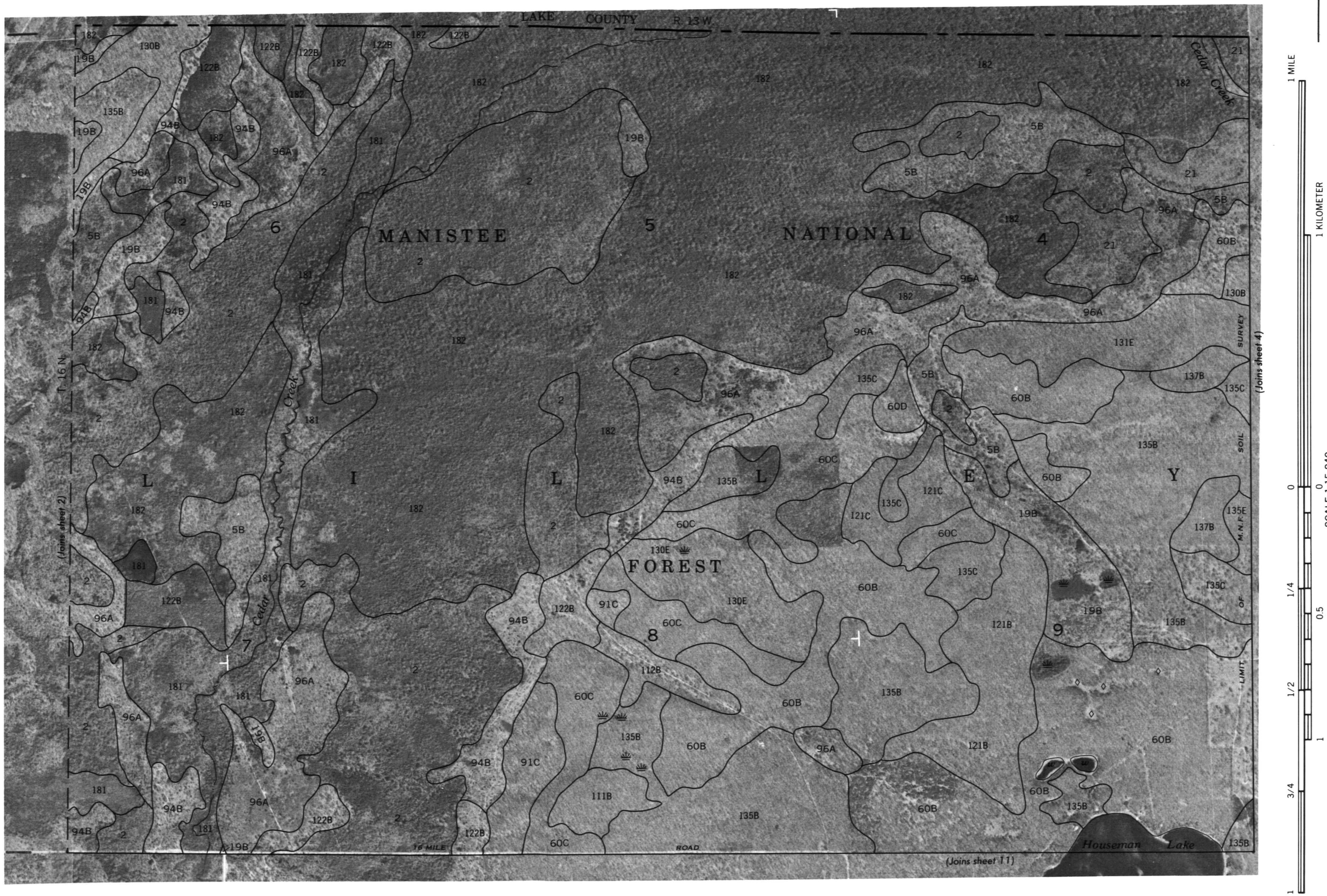
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 29

3

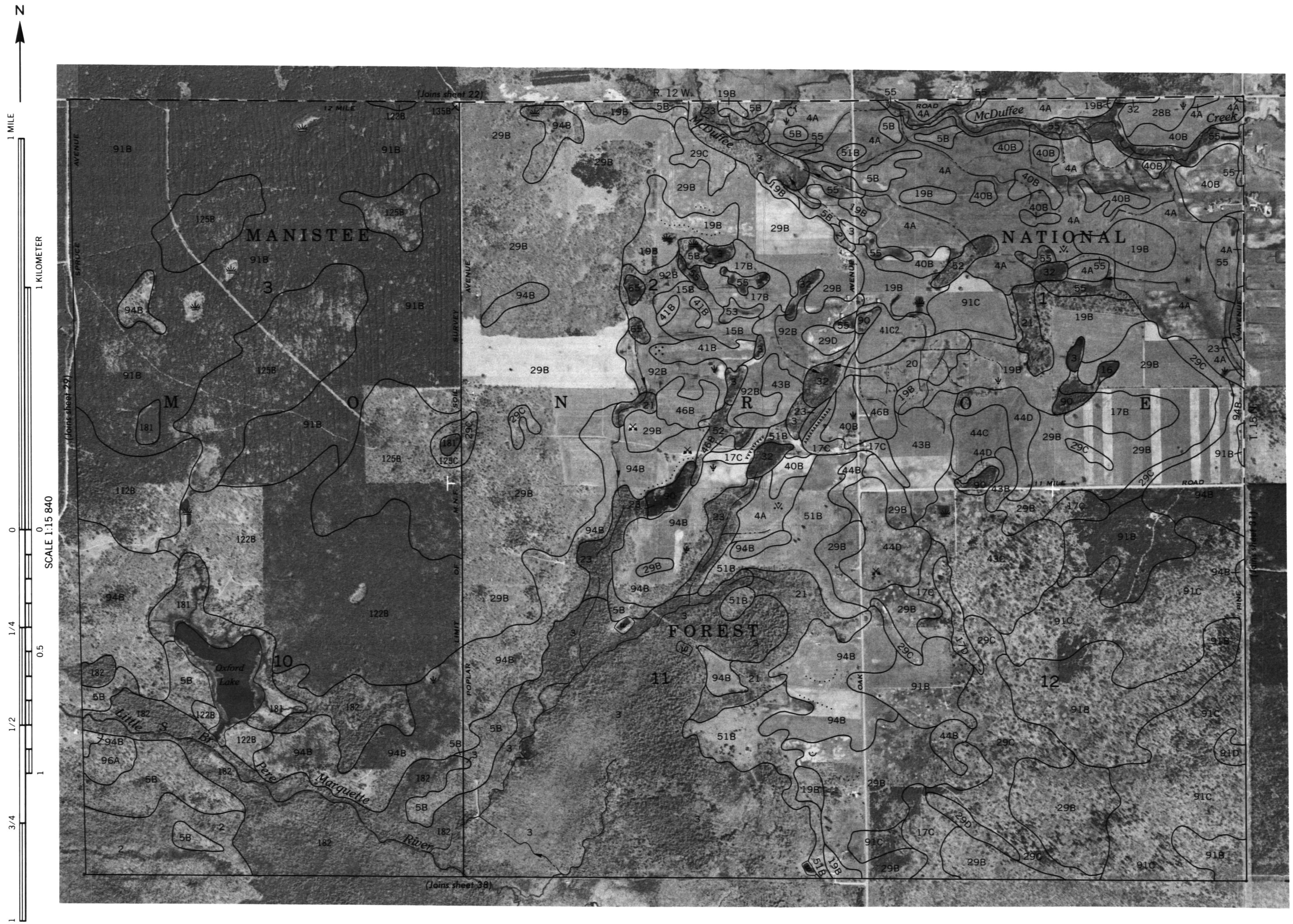
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 3



(30)

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 30



NEWAYGO COUNTY, MICHIGAN NO. 30

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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NEWAYGO COUNTY, MICHIGAN NO. 31

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 32

NEWAYGO COUNTY, MICHIGAN NO. 32

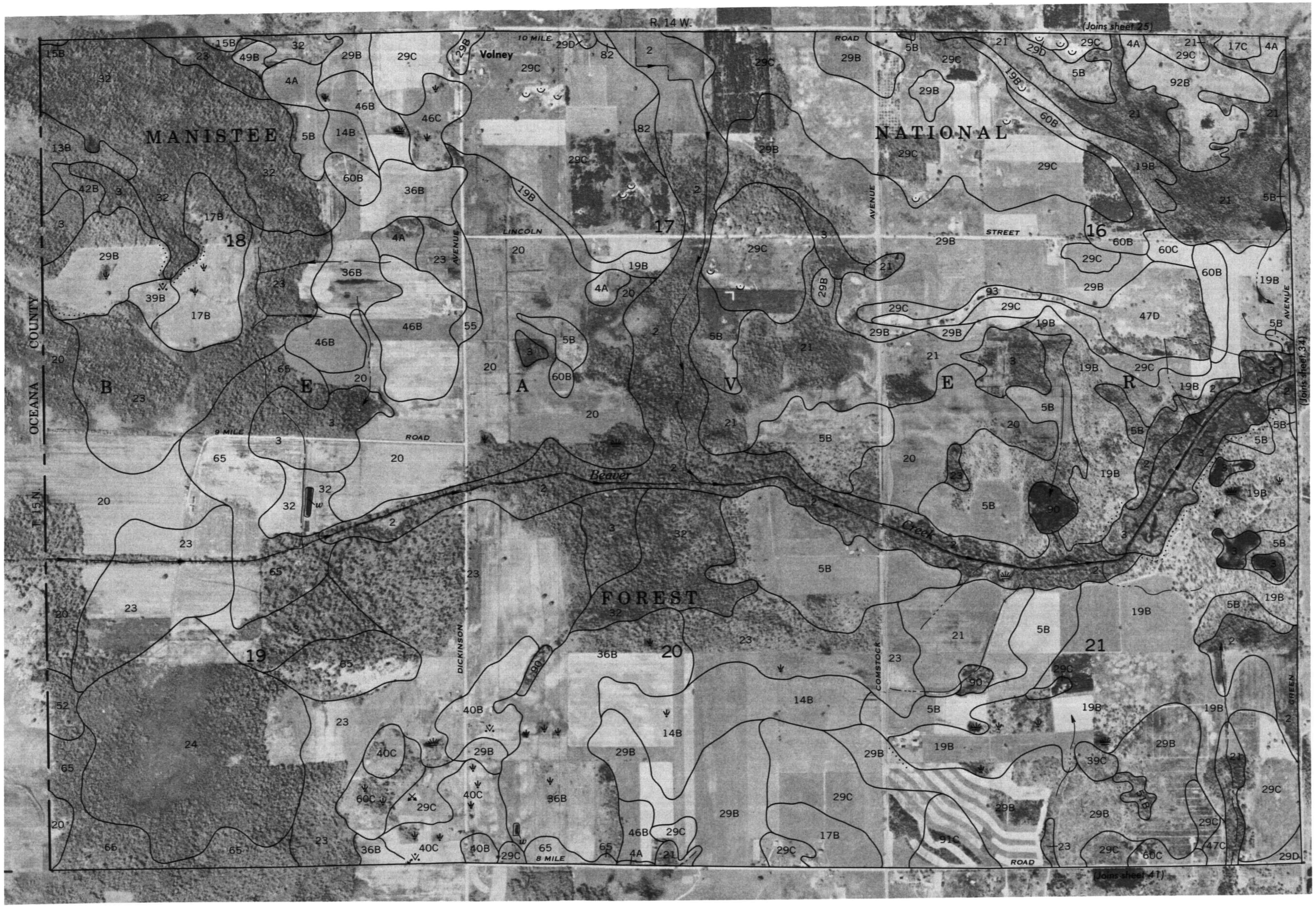
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

33

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 33



1 MILE
1 KILOMETER
0
1/4
1/2
3/4
1
0
0.5
1
SCALE 1:15 840

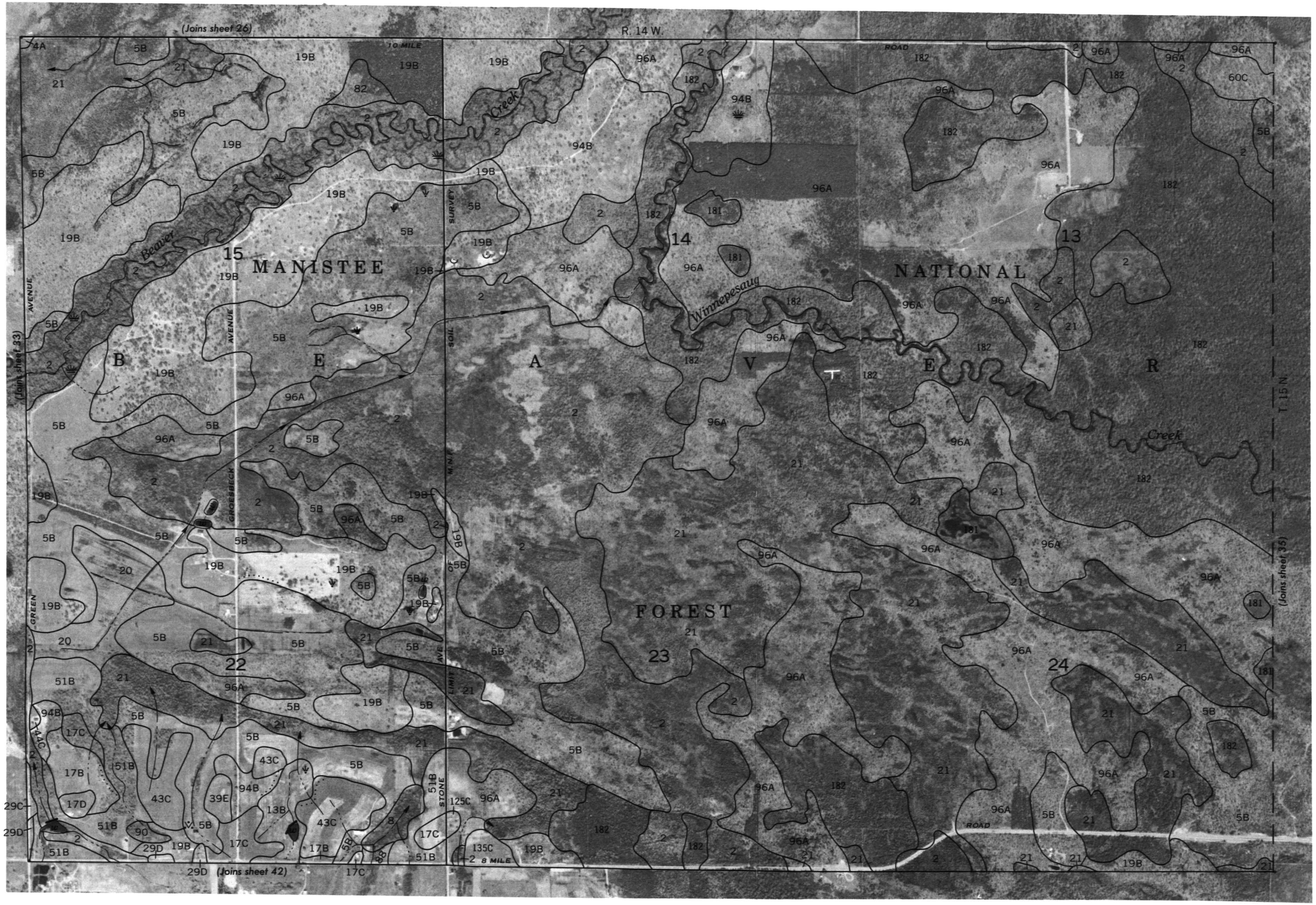
SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 34

N

1 MILE

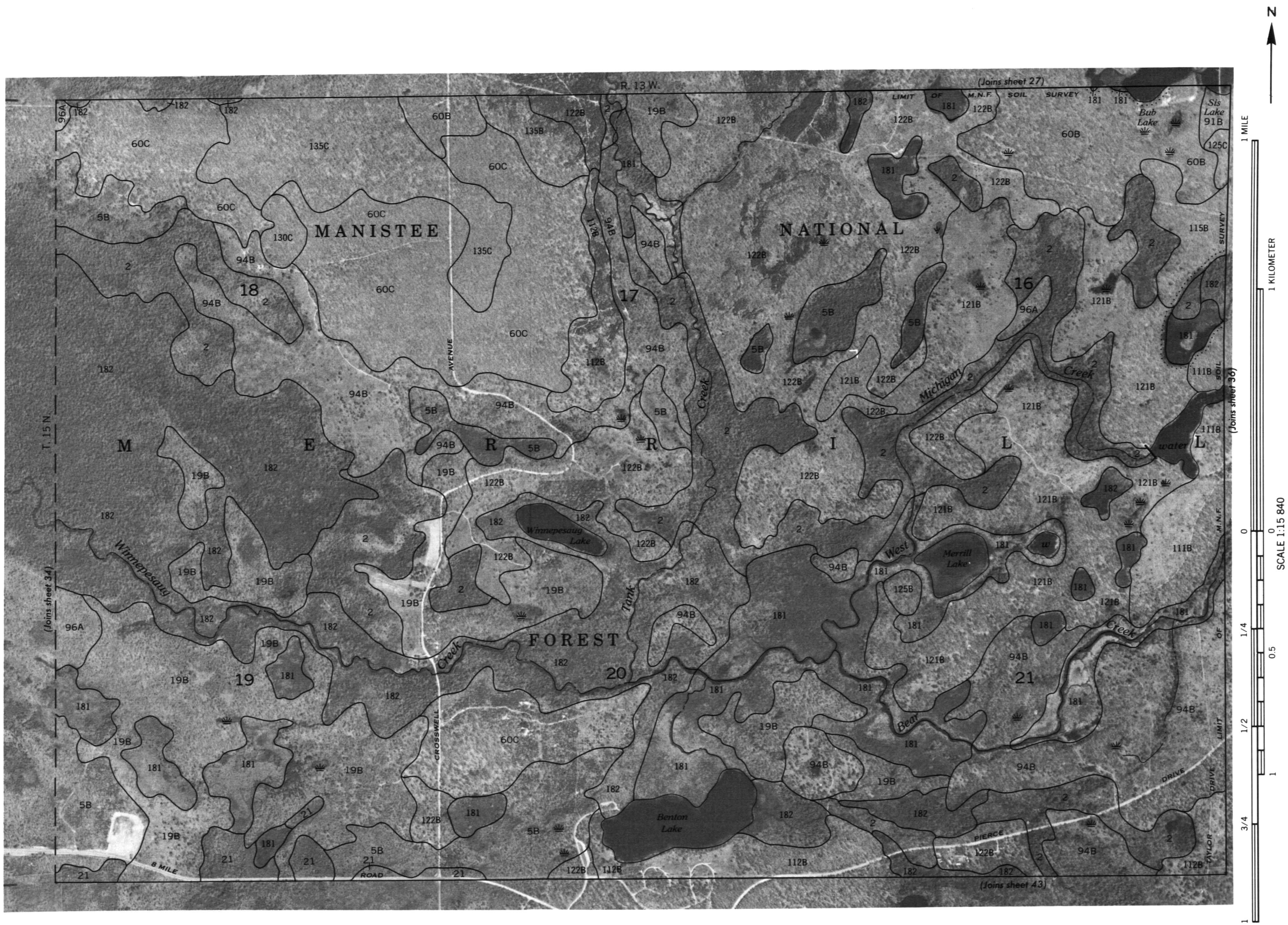
1 KILOMETER

SCALE 1:15 840



NEWAYGO COUNTY, MICHIGAN NO. 34

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 35

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 36

NEWAYGO COUNTY, MICHIGAN NO. 36

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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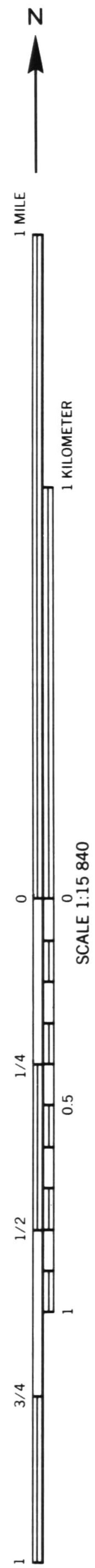
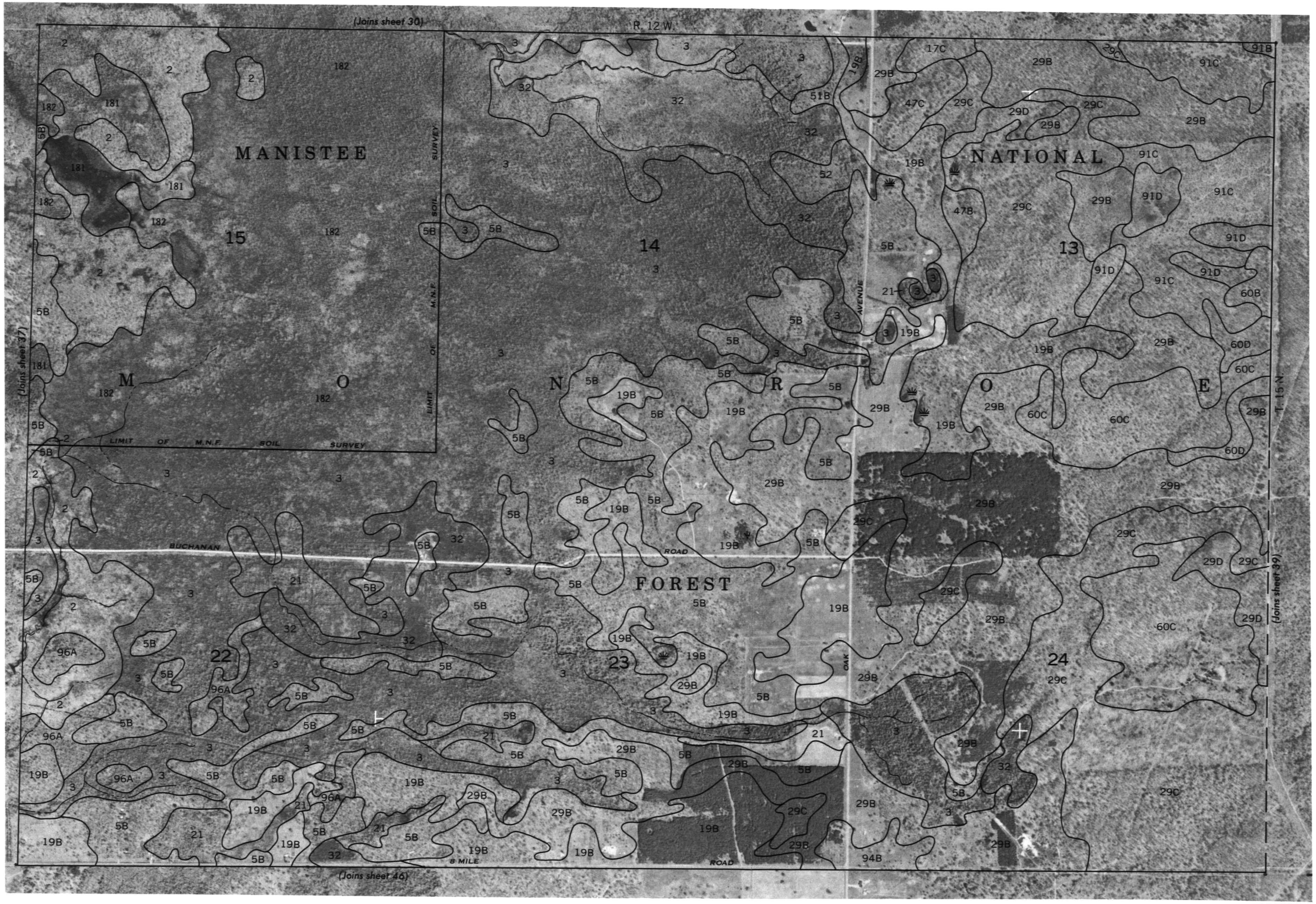
NEWAYGO COUNTY, MICHIGAN NO. 37

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 38

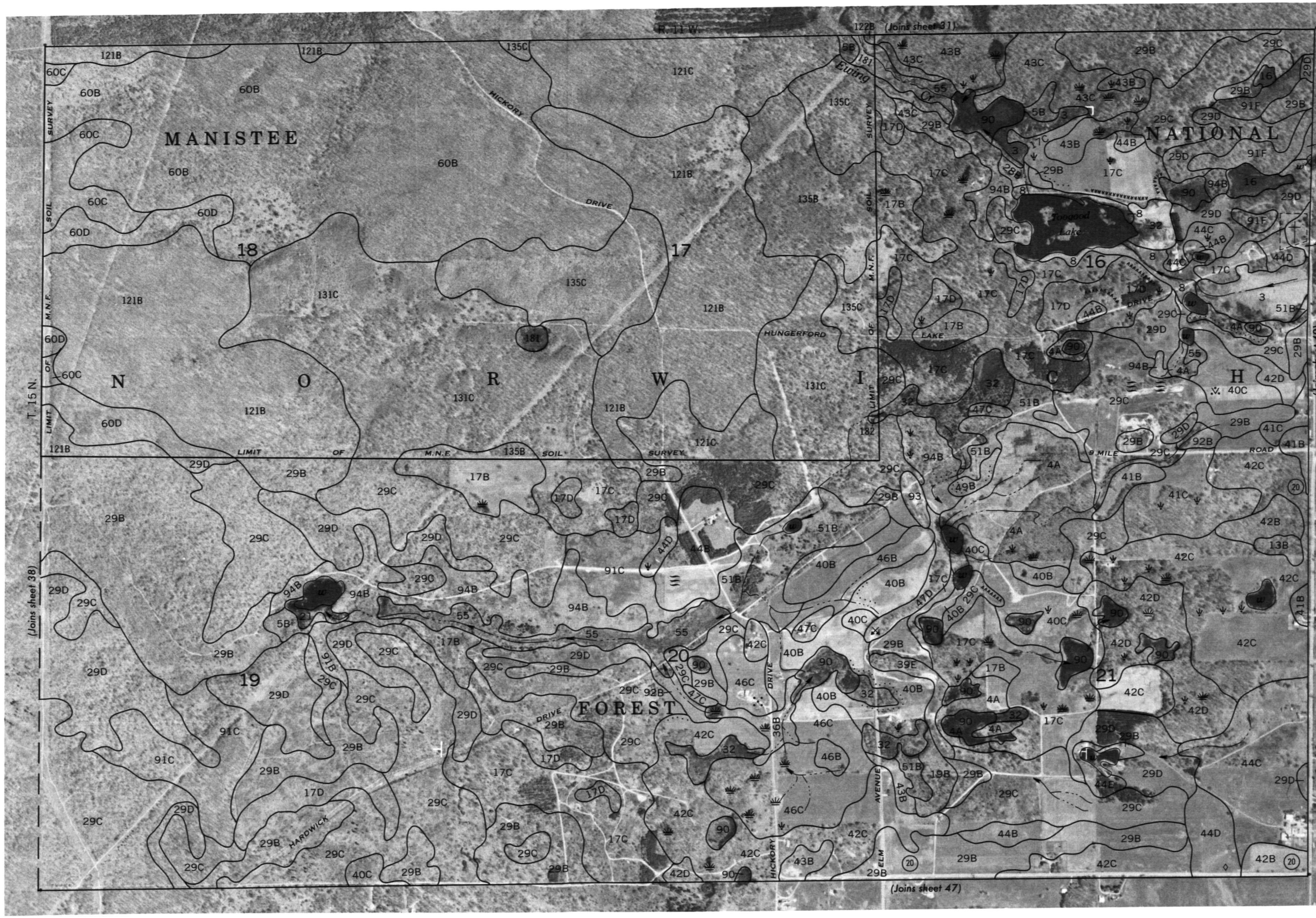




NEWAYGO COUNTY, MICHIGAN NO. 38

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 4

N

1 MILE

1 KILOMETER

SCALE 1:15 840

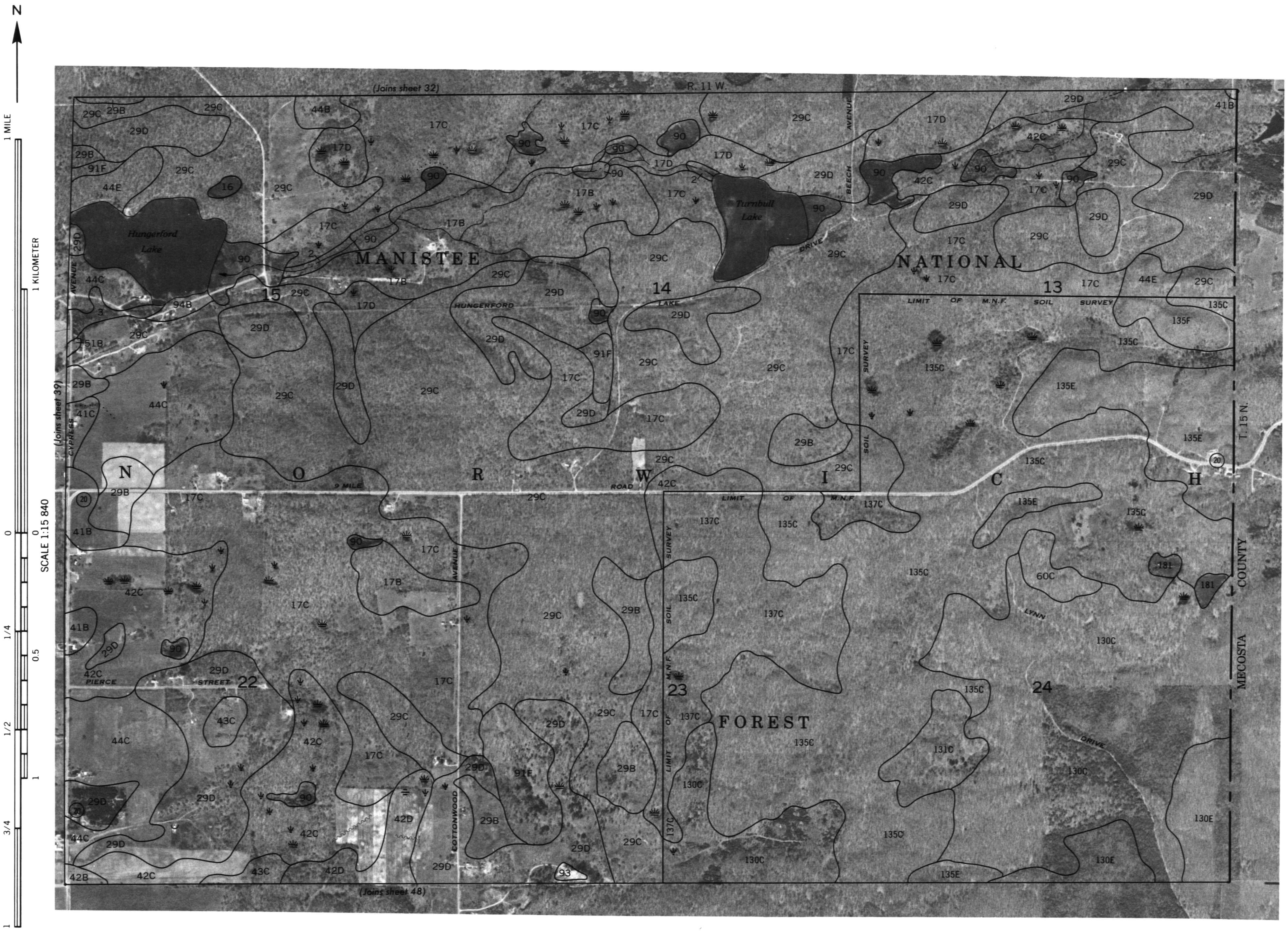
0 1/4 1/2 3/4 1

0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 4

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 40



NEWAYGO COUNTY, MICHIGAN NO. 40

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

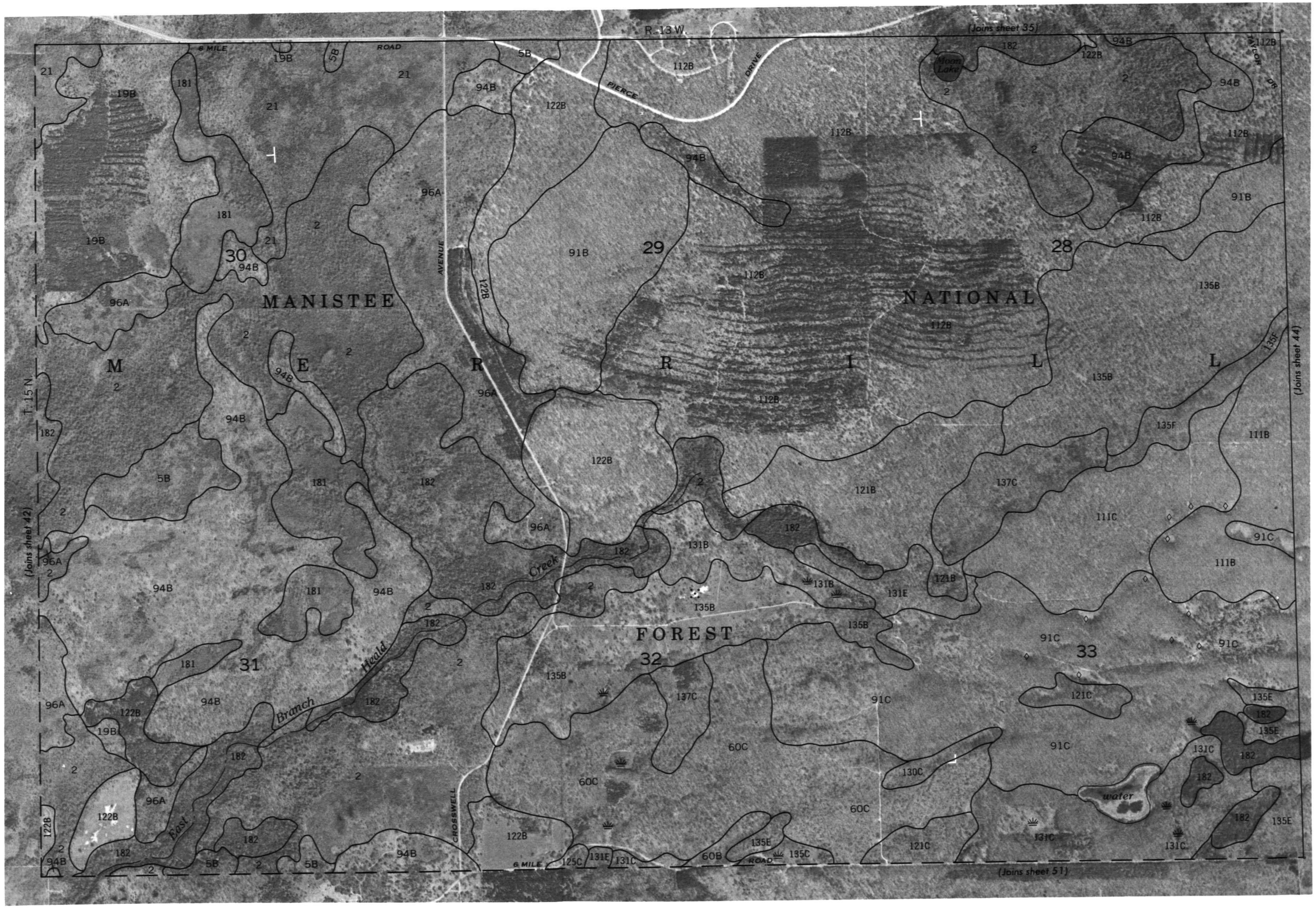
0 0.5 1

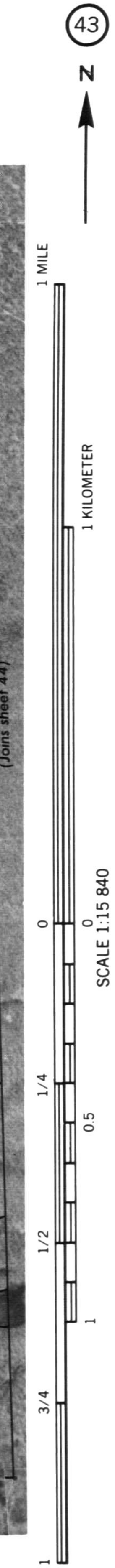
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 41

NEWAYGO COUNTY, MICHIGAN NO. 42

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.





This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 43

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 44

NEWAYGO COUNTY, MICHIGAN NO. 44

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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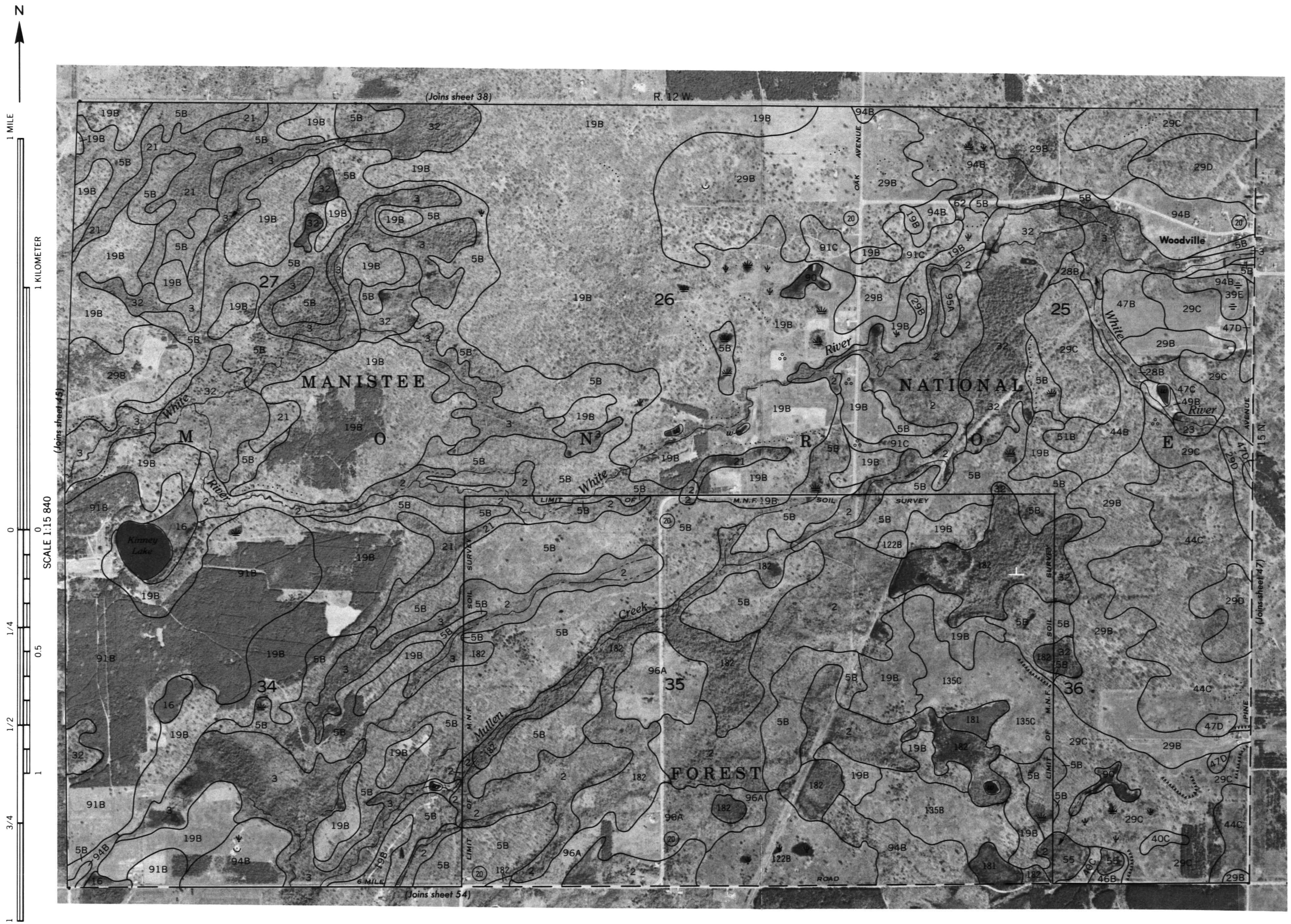
NEWAYGO COUNTY, MICHIGAN NO. 45

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 46



NEWAYGO COUNTY, MICHIGAN NO. 46

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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NEWAYGO COUNTY, MICHIGAN NO. 47

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 48

N

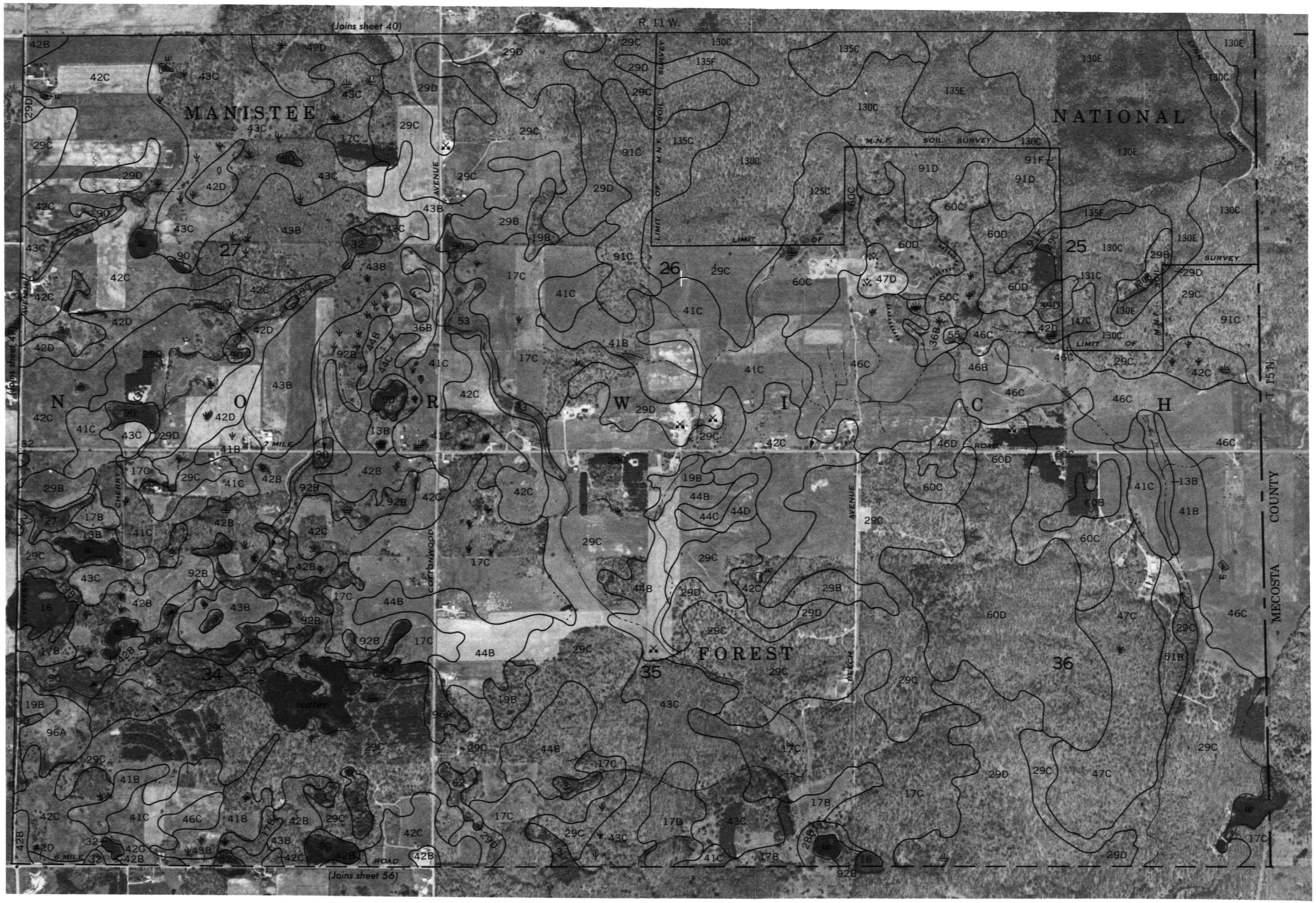
1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1



NEWAYGO COUNTY, MICHIGAN NO. 48

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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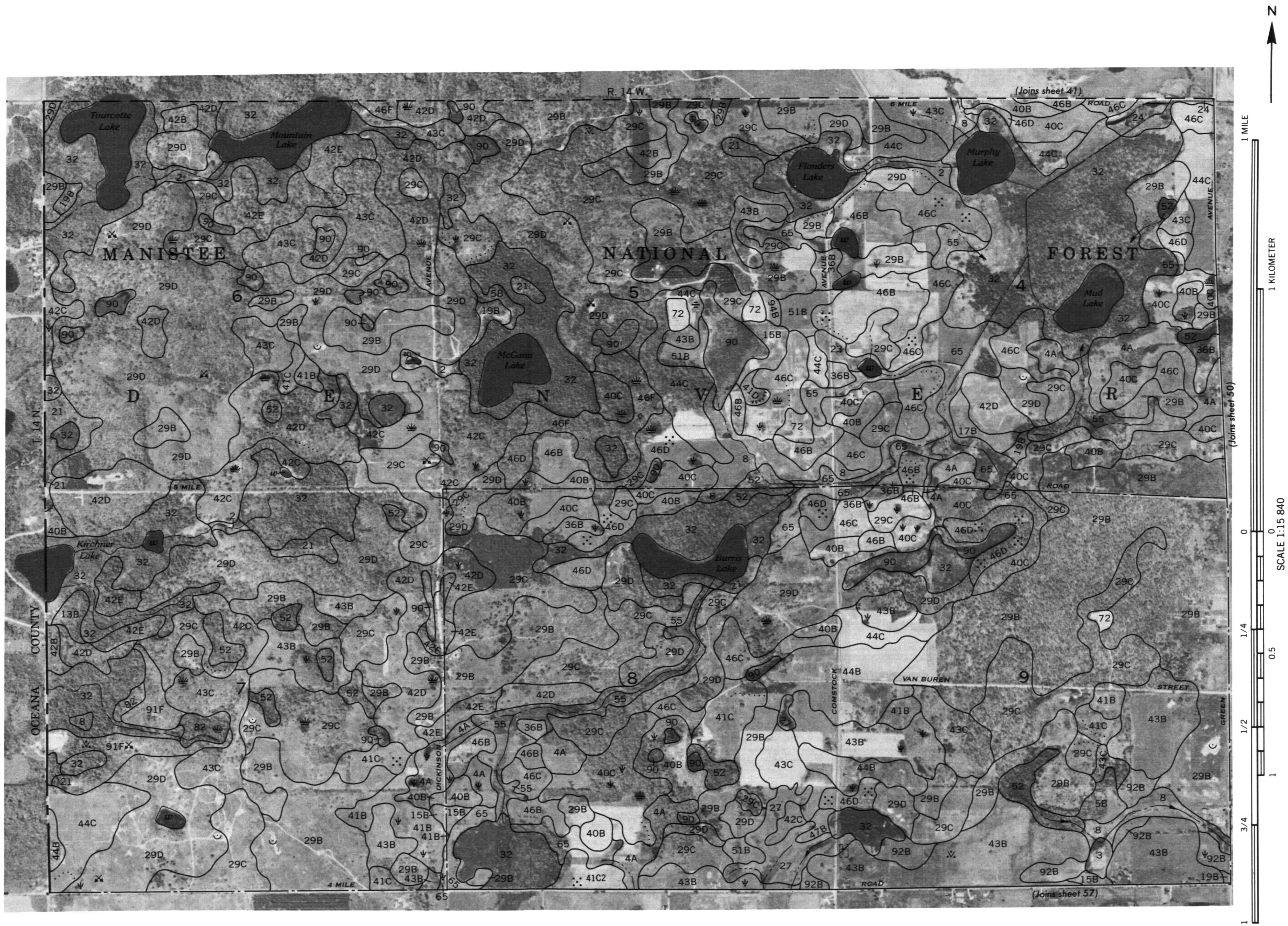
NEWAYGO COUNTY, MICHIGAN NO. 49



5

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 5

1 MILE

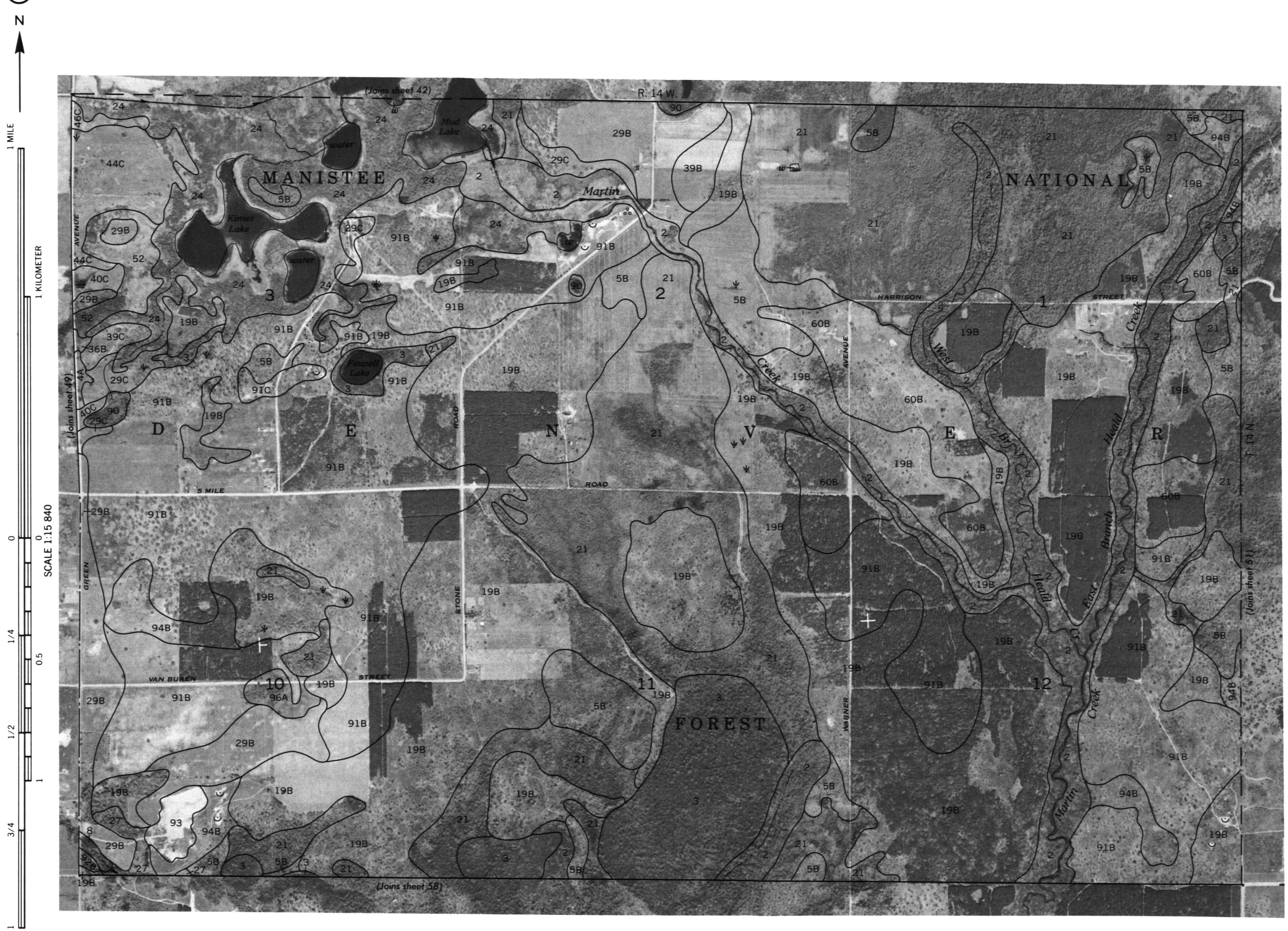
1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 50



NEWAYGO COUNTY, MICHIGAN NO. 50

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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NEWAYGO COUNTY, MICHIGAN NO. 51

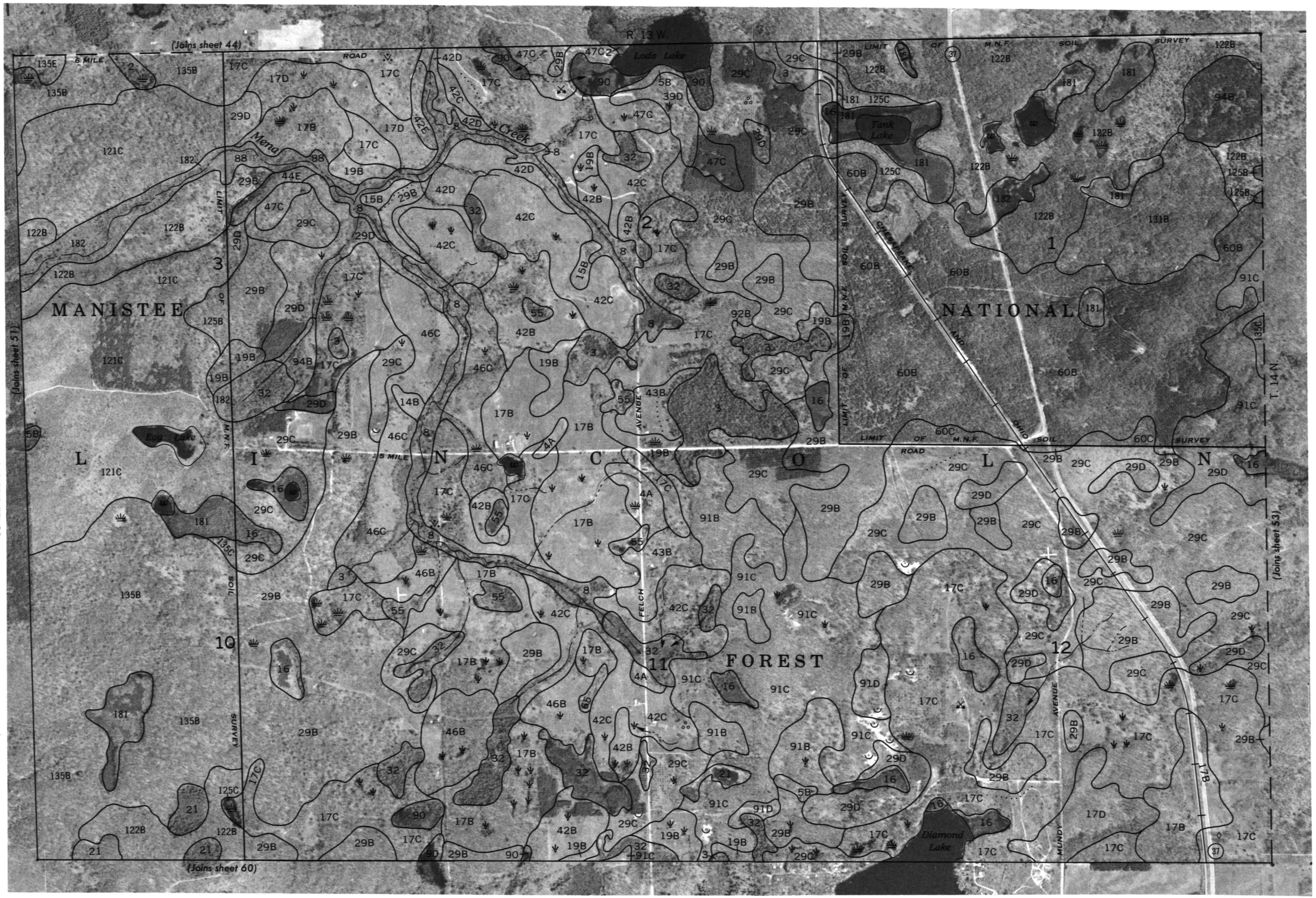
52

N

1 MILE

1 KILOMETER

SCALE 1:15 840



NEWAYGO COUNTY, MICHIGAN NO. 52

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

53

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 53

1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 54

N

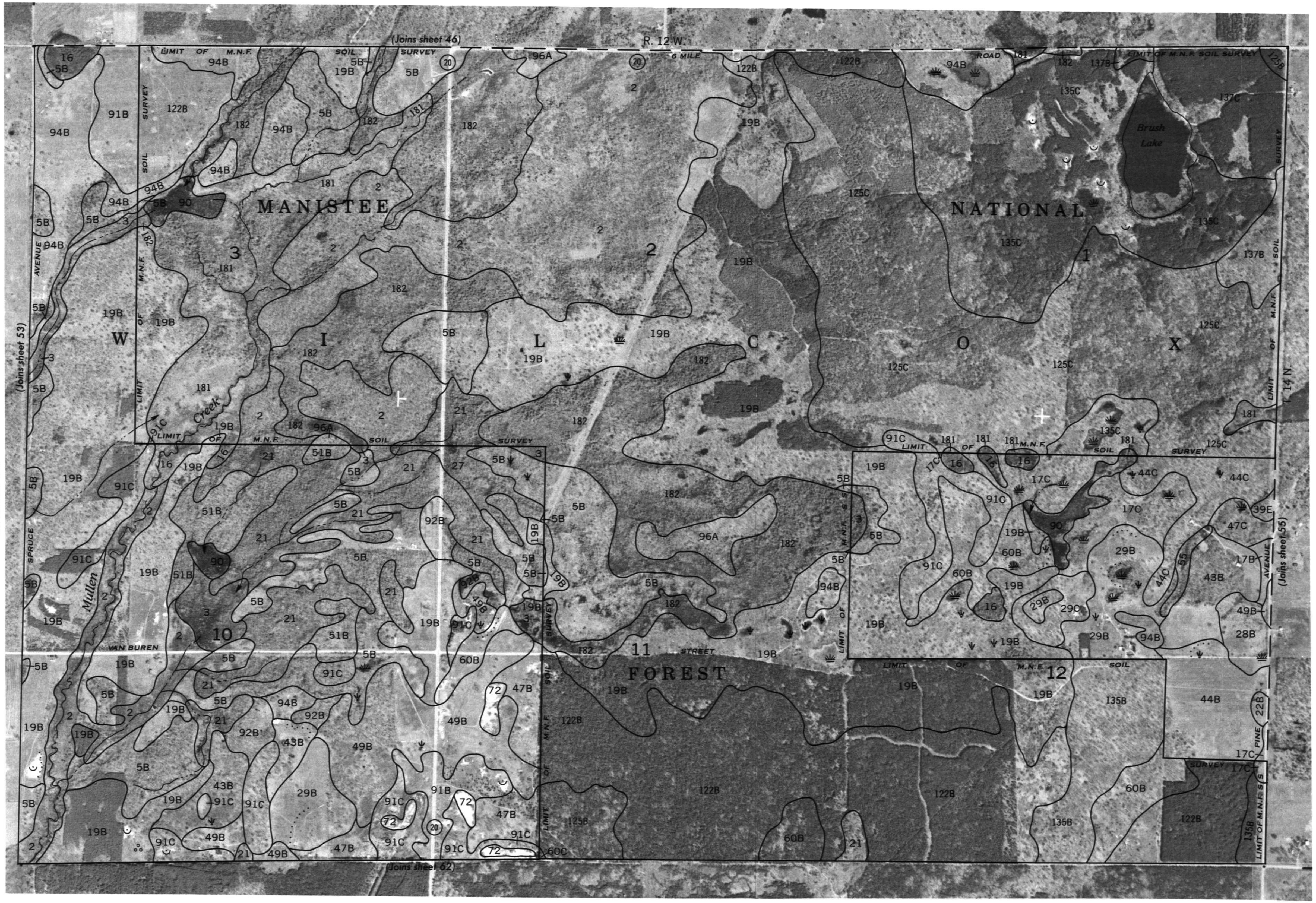
1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

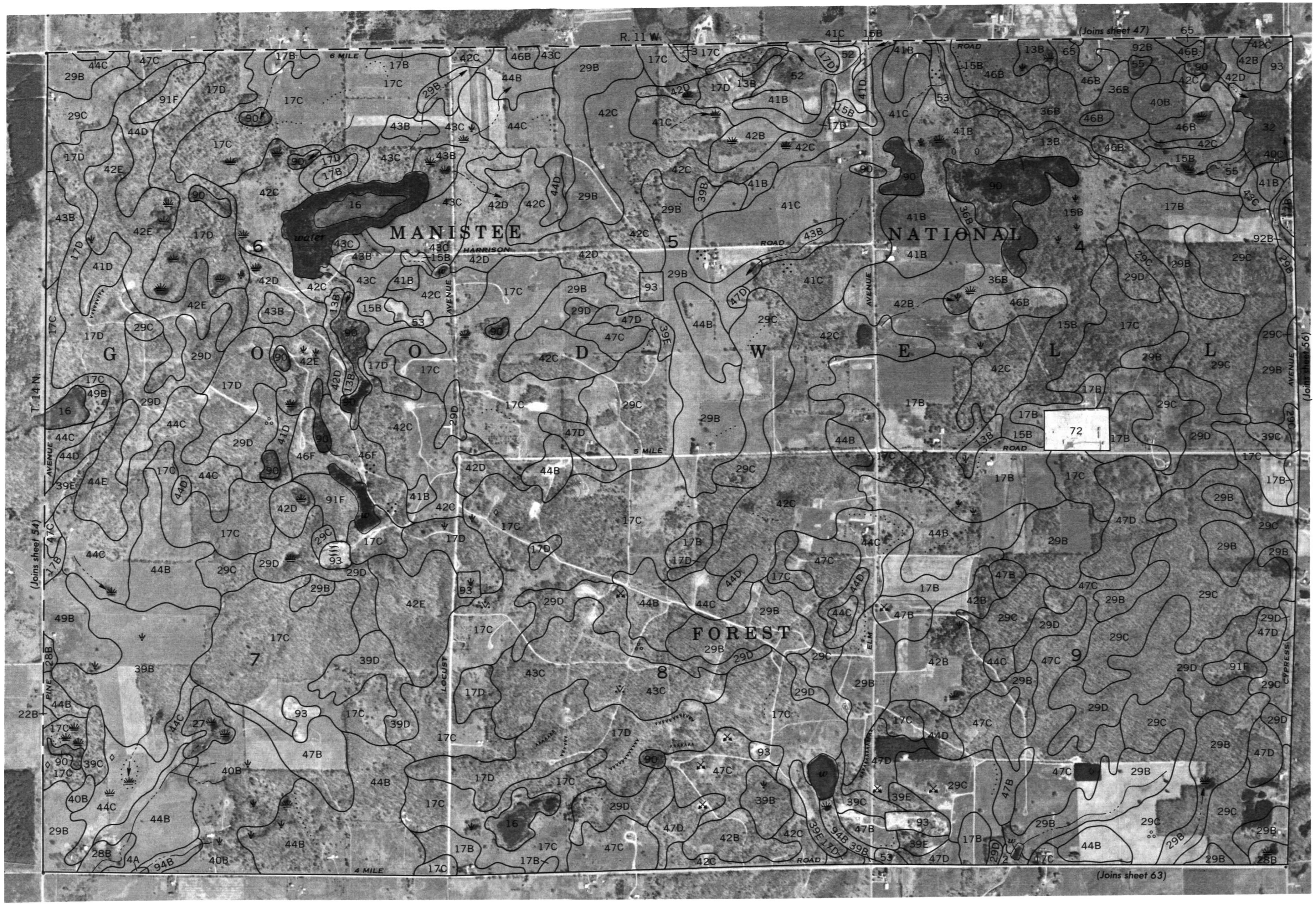


NEWAYGO COUNTY, MICHIGAN NO. 54

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

55

N



1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

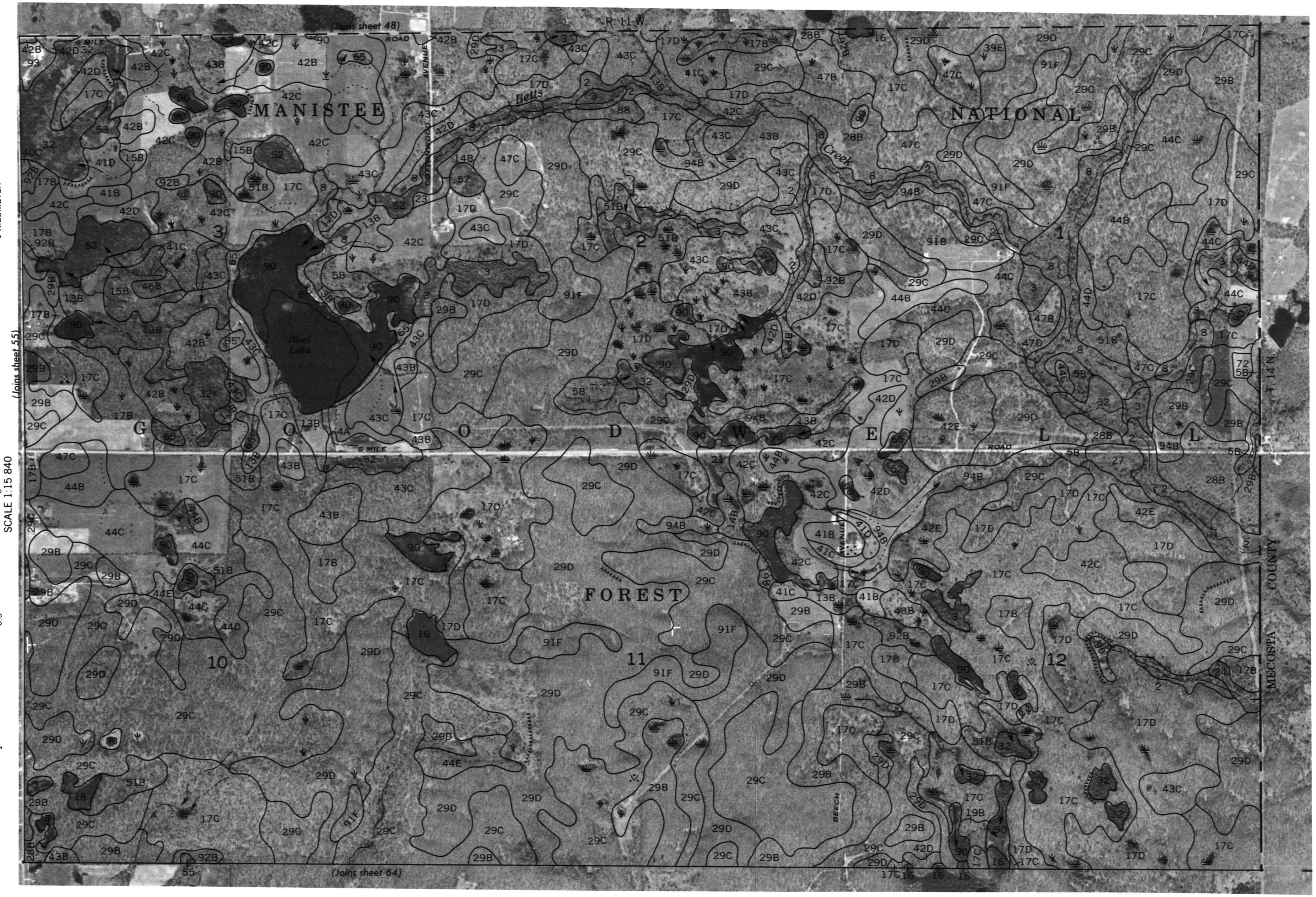
0 0.5 1

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 55

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 56

N



1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 56

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

57

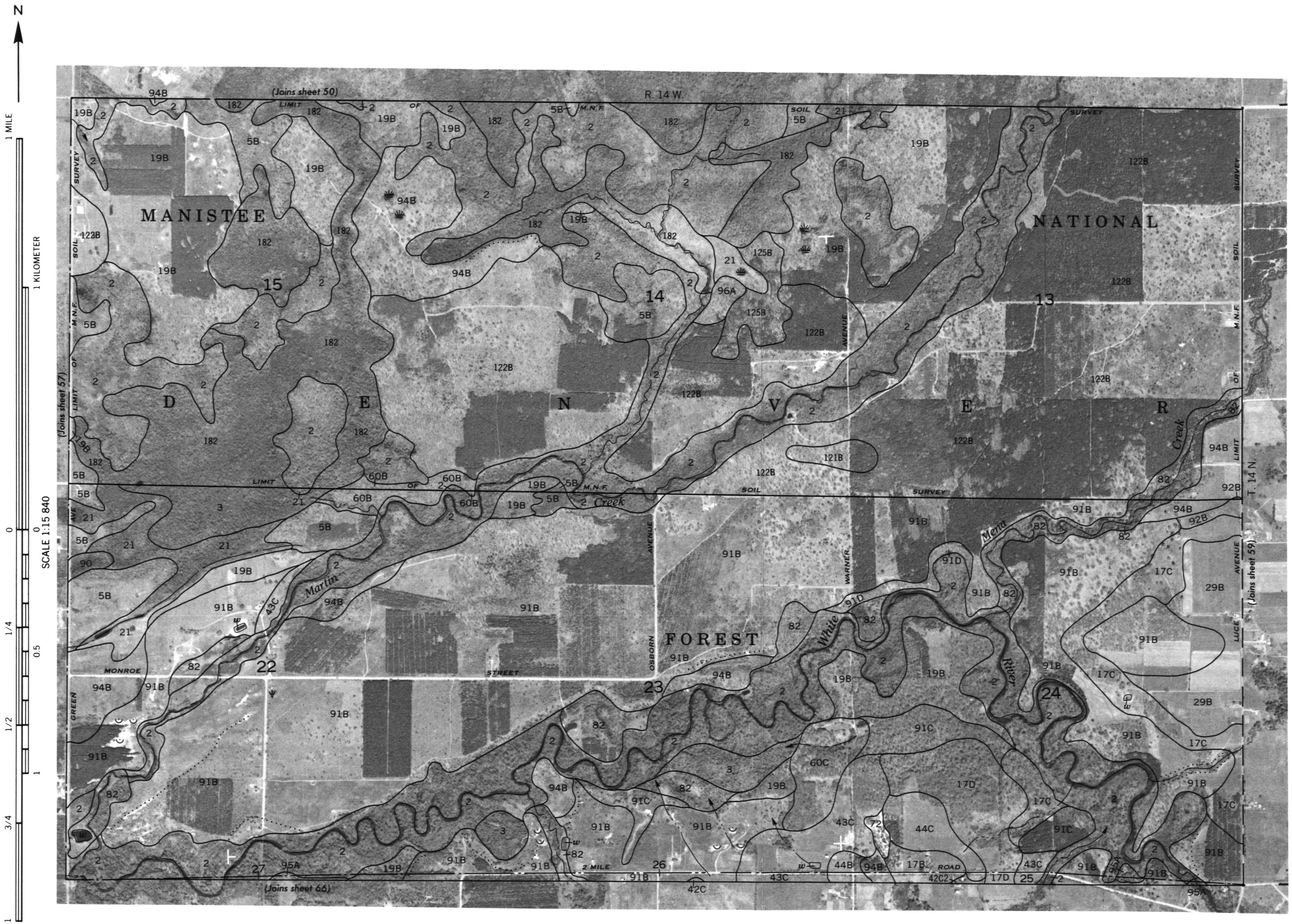
N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 57

1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 58



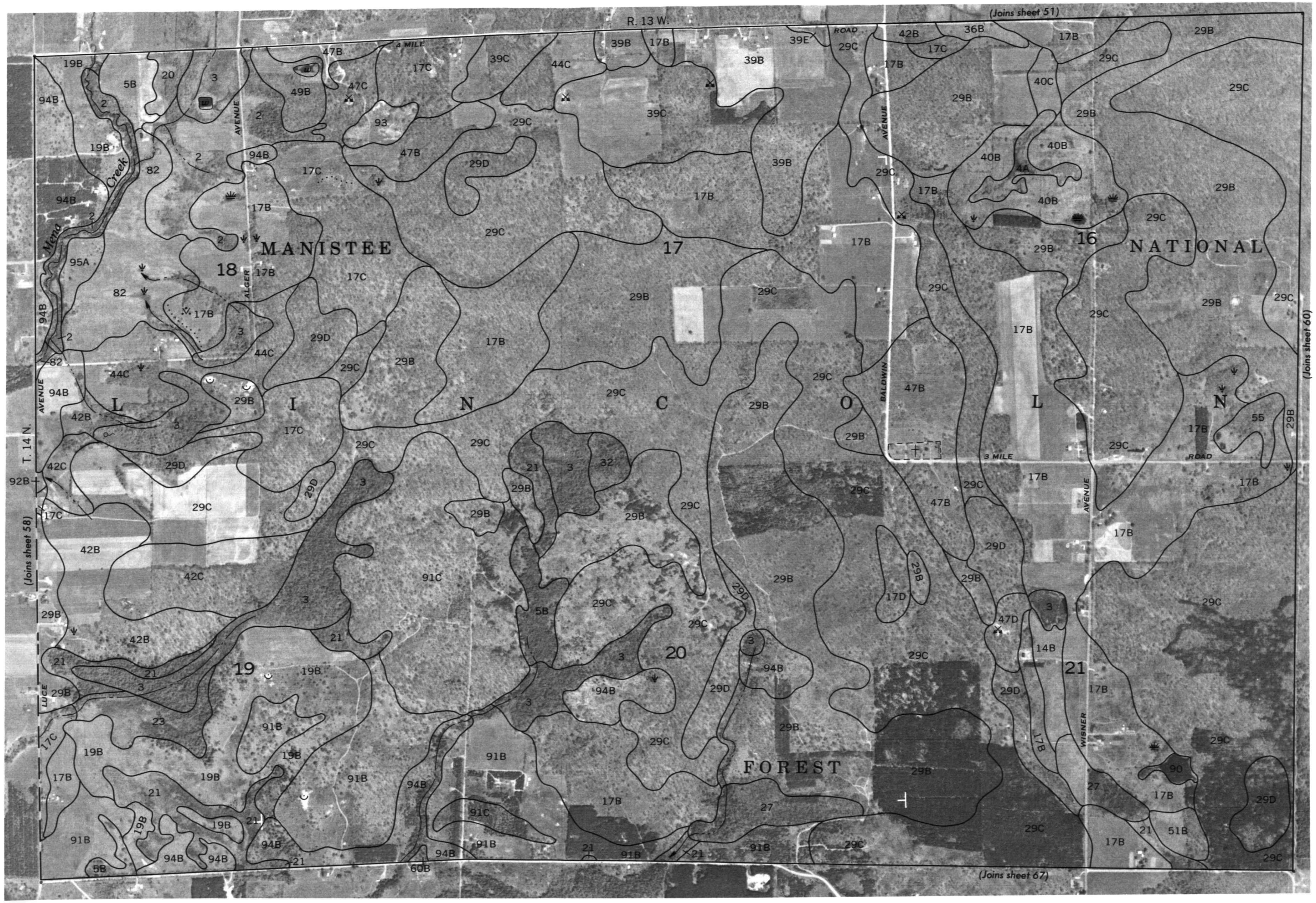
NEWAYGO COUNTY, MICHIGAN NO. 58

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 59

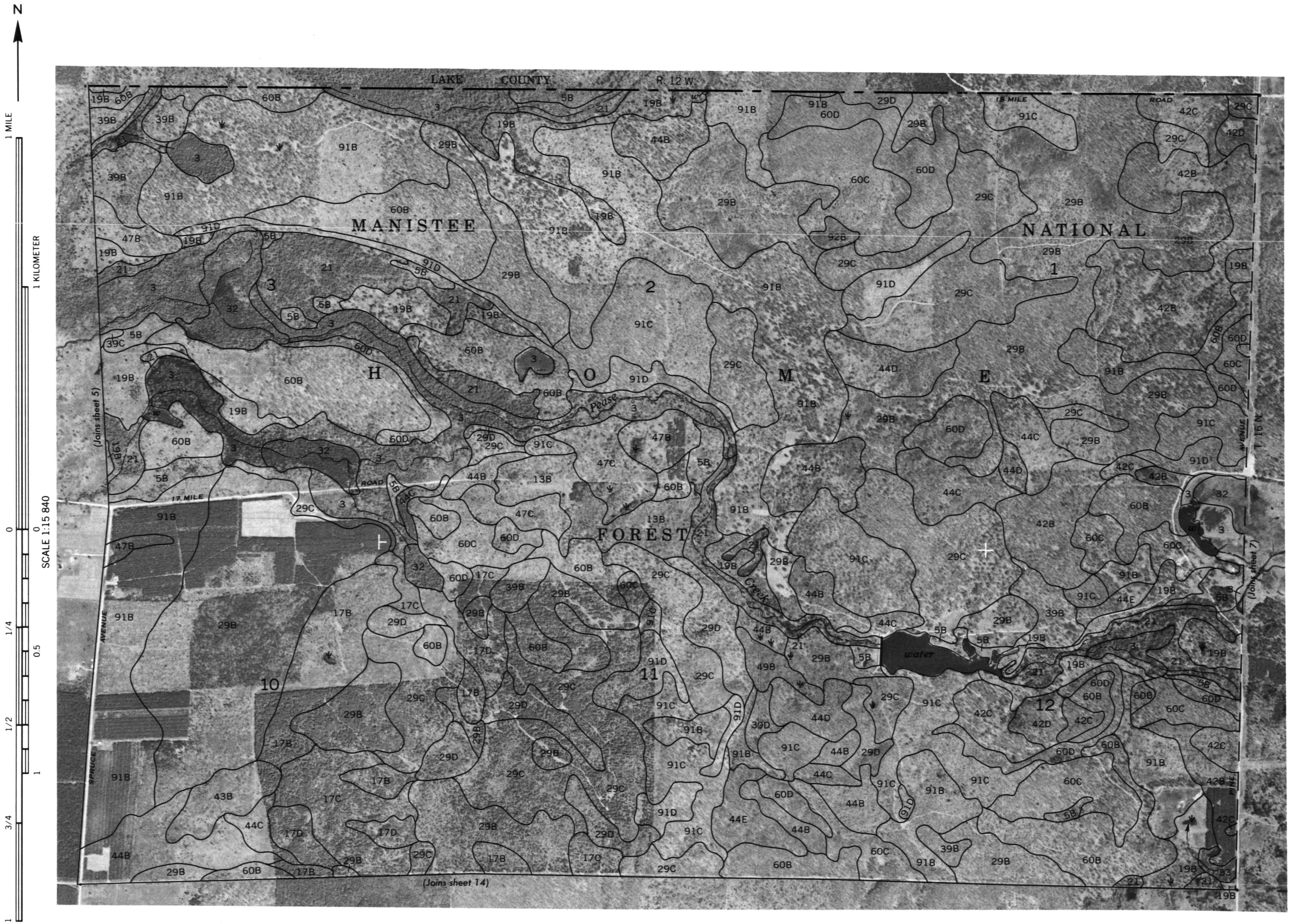
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

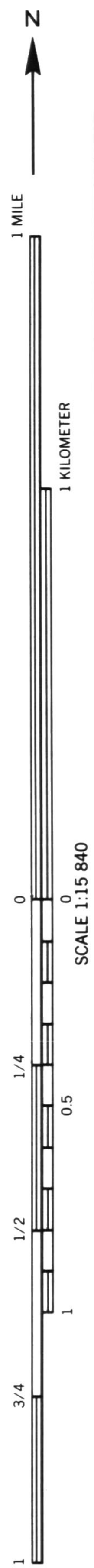
SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 6

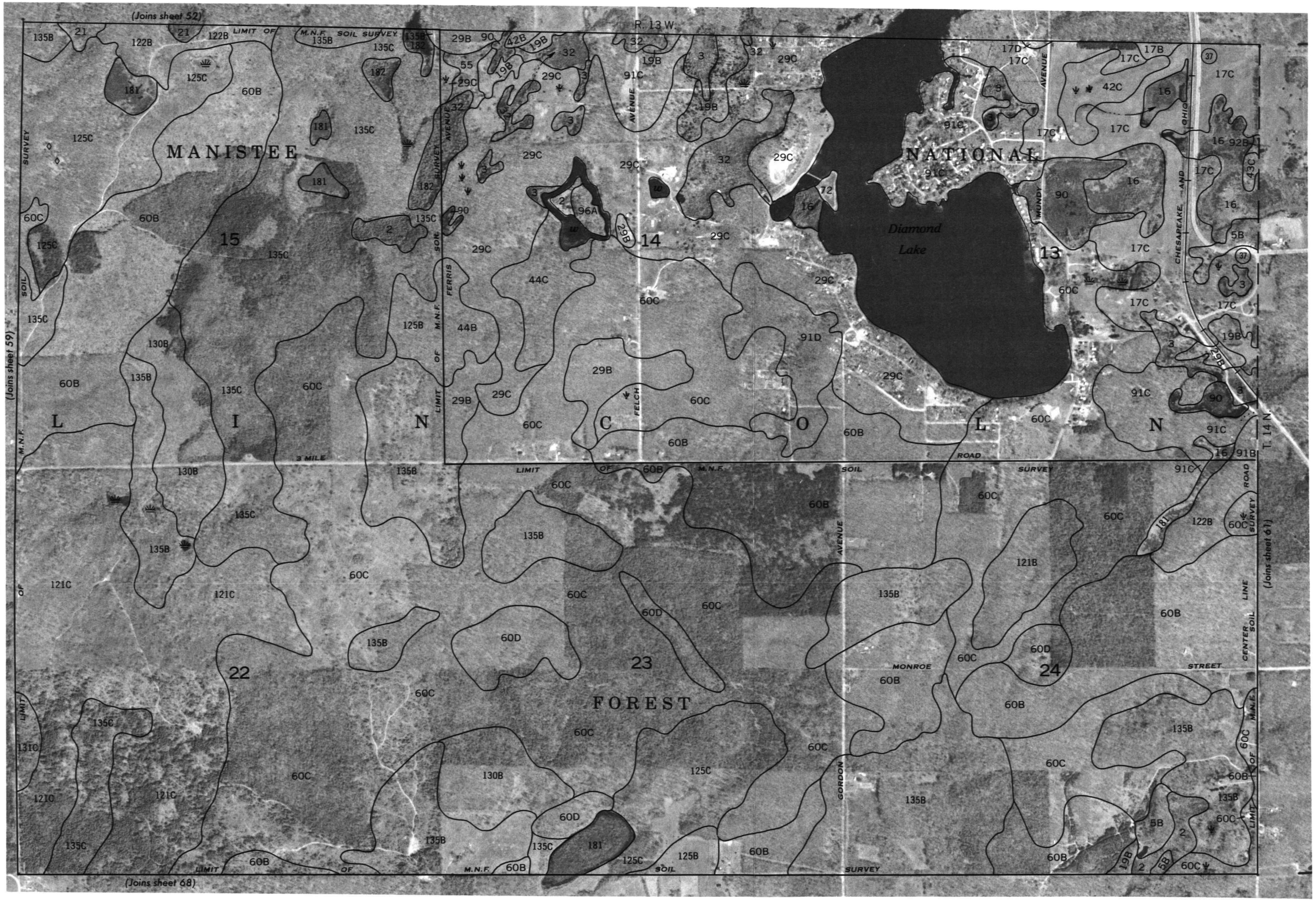


NEWAYGO COUNTY, MICHIGAN NO. 6

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 60





NEWAYGO COUNTY, MICHIGAN NO. 60

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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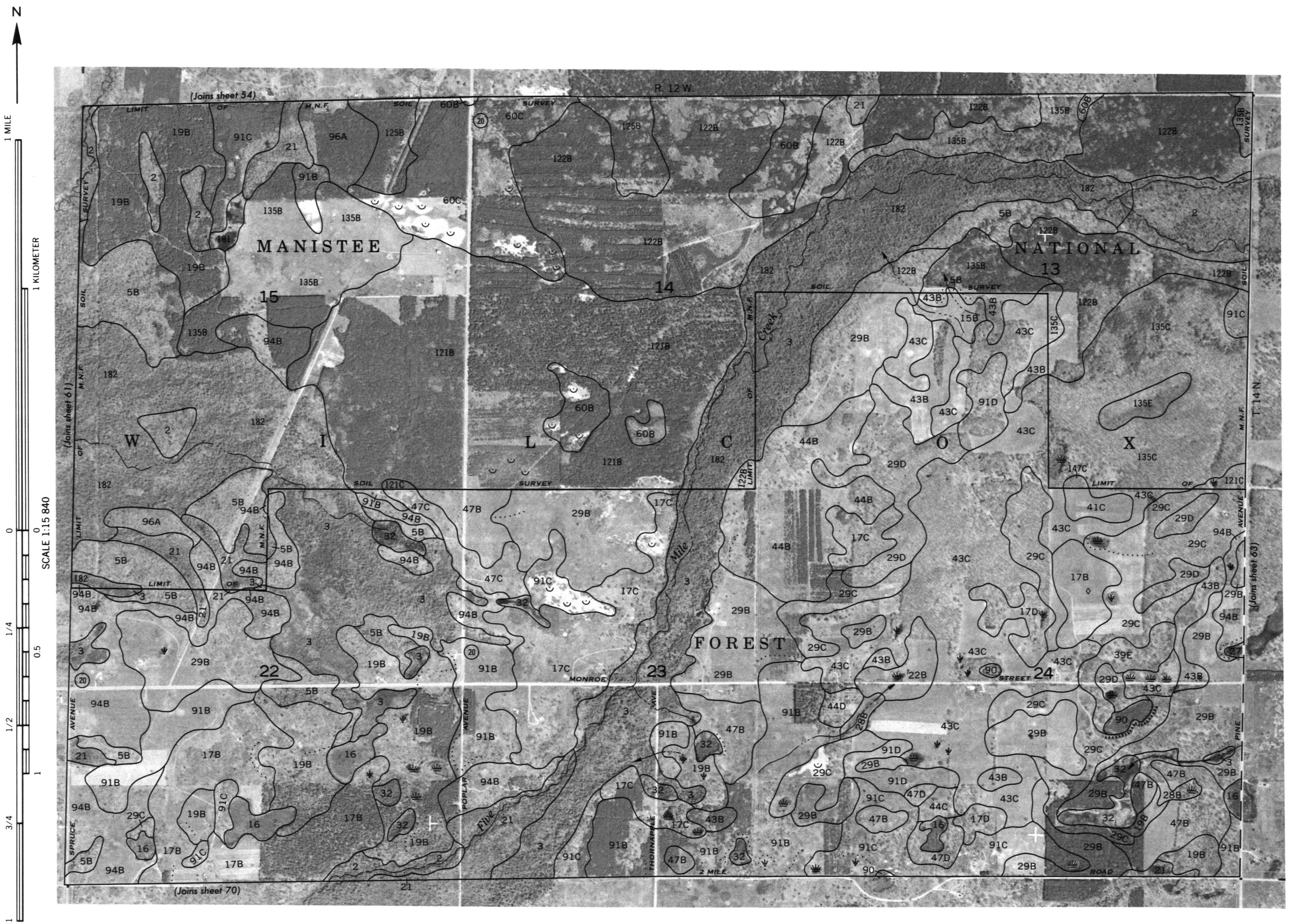
NEWAYGO COUNTY, MICHIGAN NO. 61

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 62



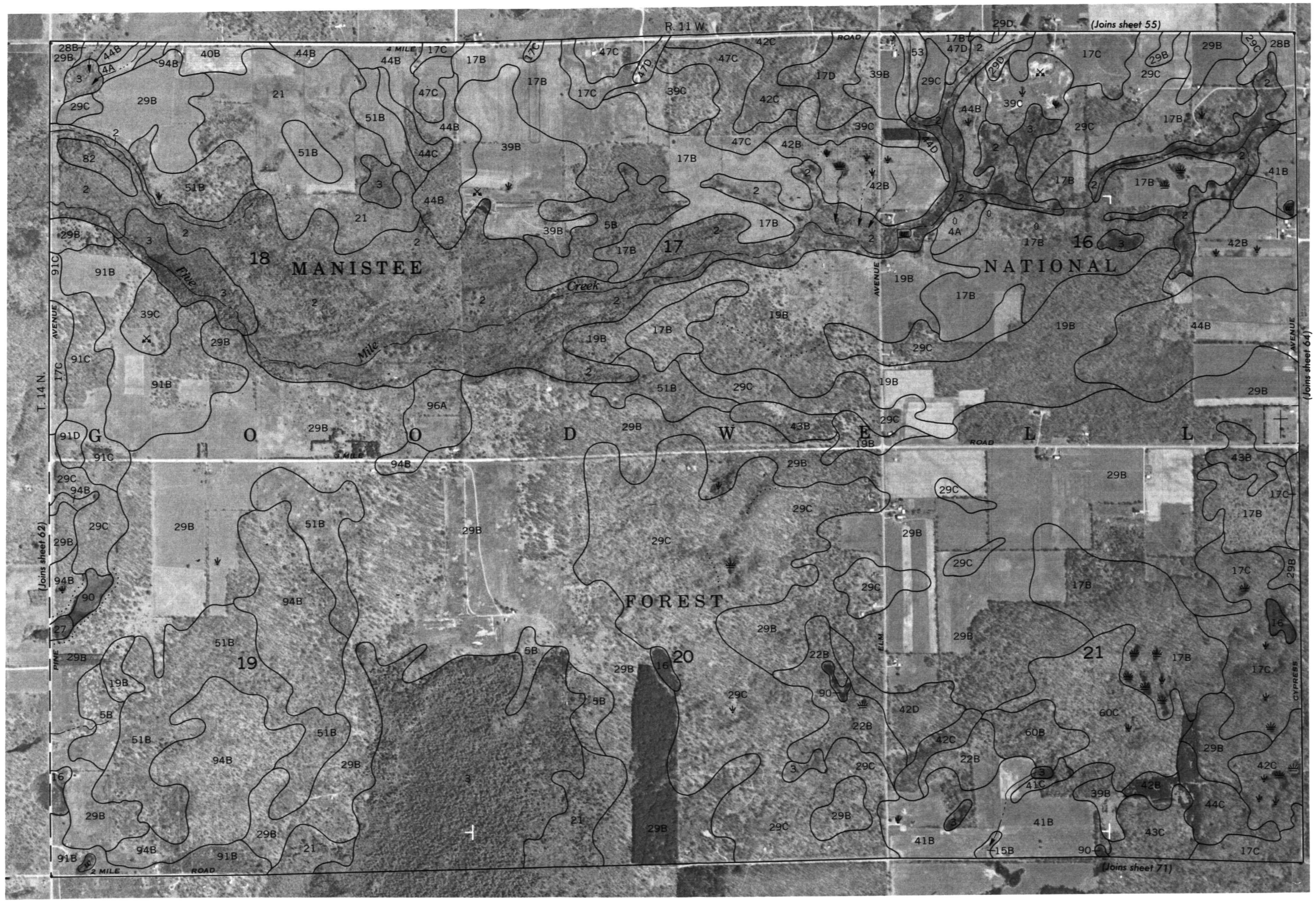
NEWAYGO COUNTY, MICHIGAN NO. 62

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

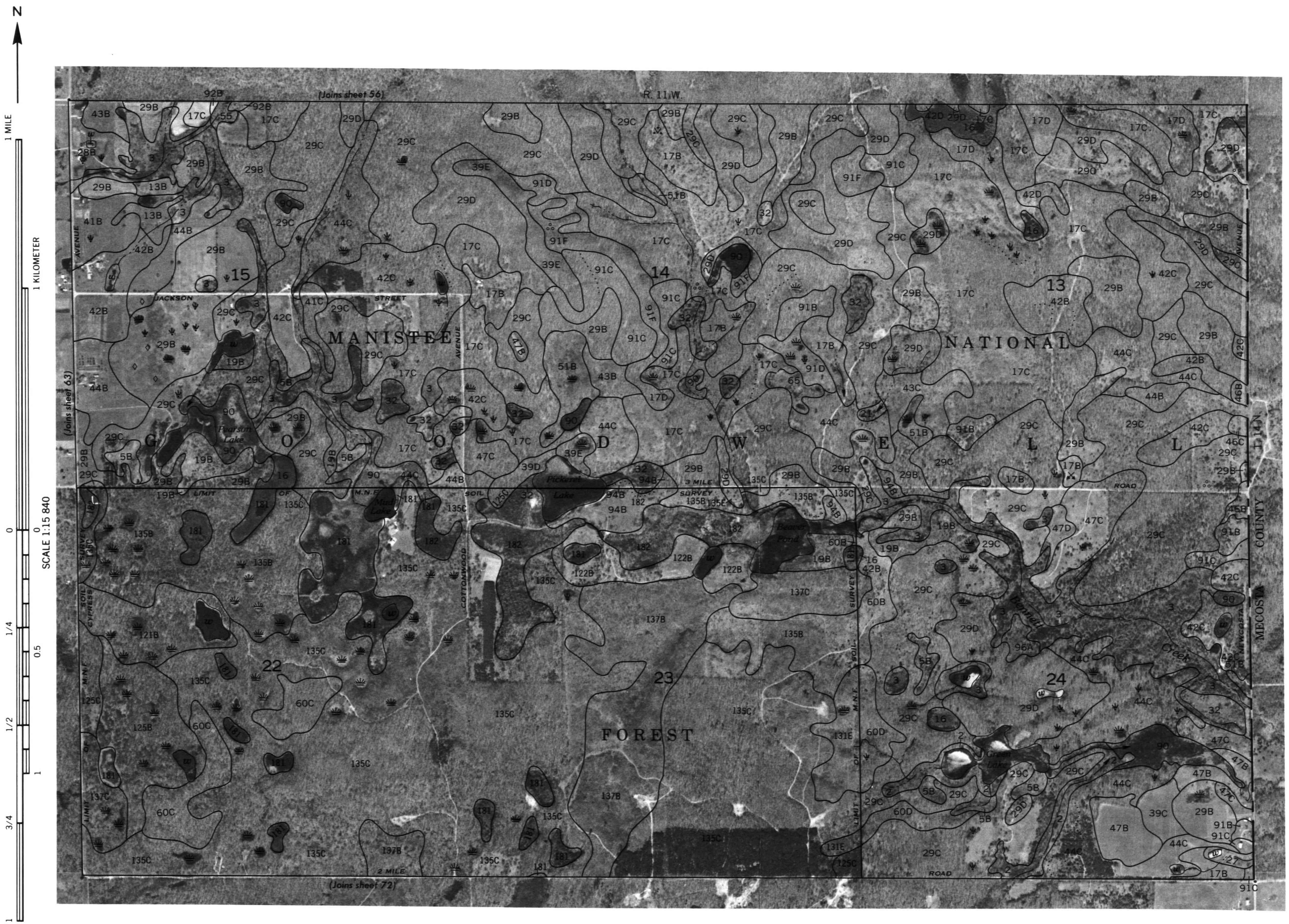
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 63



1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 64



NEWAYGO COUNTY, MICHIGAN NO. 64

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

65

N

1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

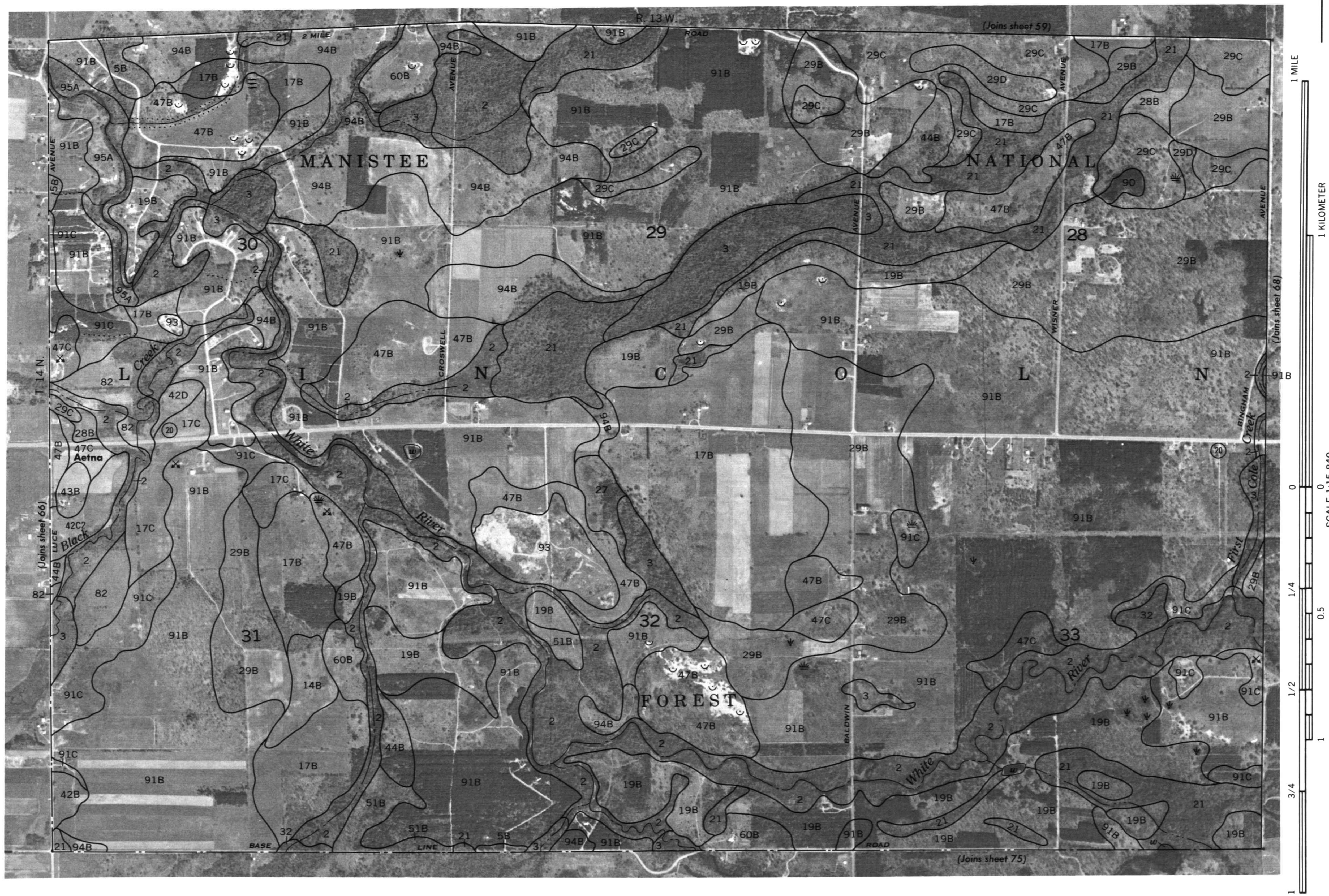
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 65

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 66

NEWAYGO COUNTY, MICHIGAN NO. 66

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 67

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 68

NEWAYGO COUNTY, MICHIGAN NO. 68

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

69

N

SCALE 1:15 840

1 MILE

1 KILOMETER

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 69

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 7

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 70

N

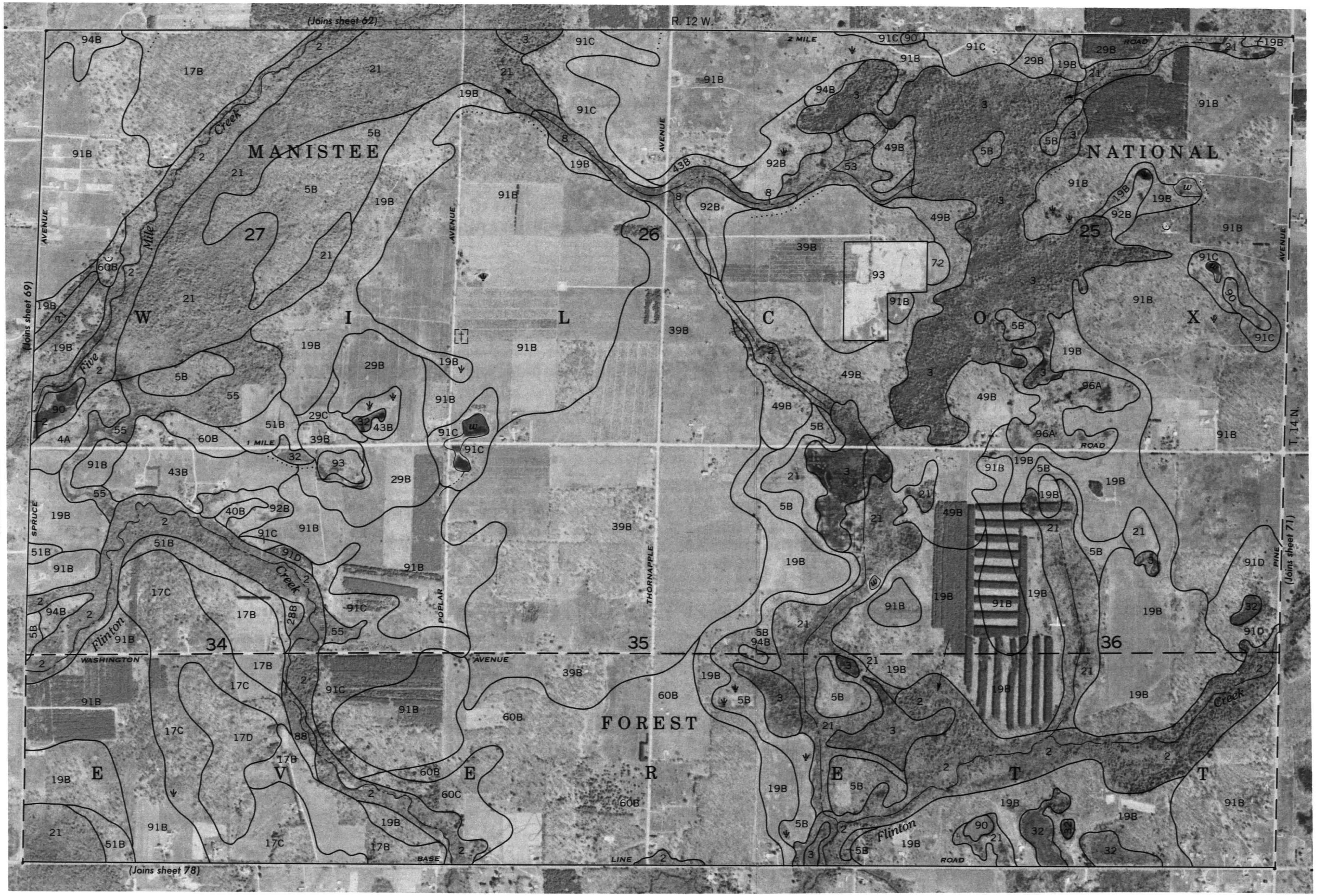
1 MILE

1 KILOMETER

SCALE 1:15 840

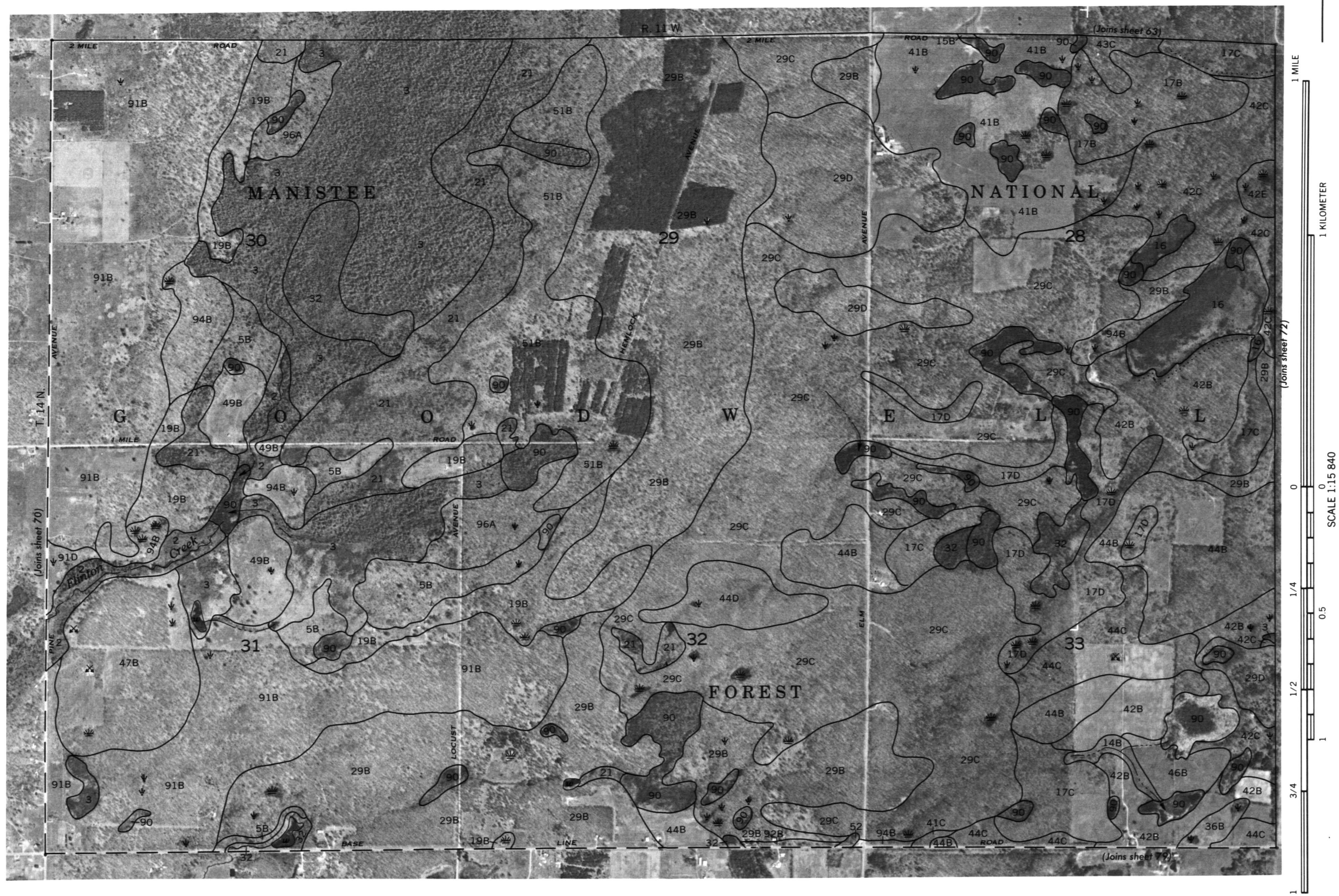
0 1/4 1/2 3/4 1

0 0.5 1



NEWAYGO COUNTY, MICHIGAN NO. 70

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 71

N

1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 72

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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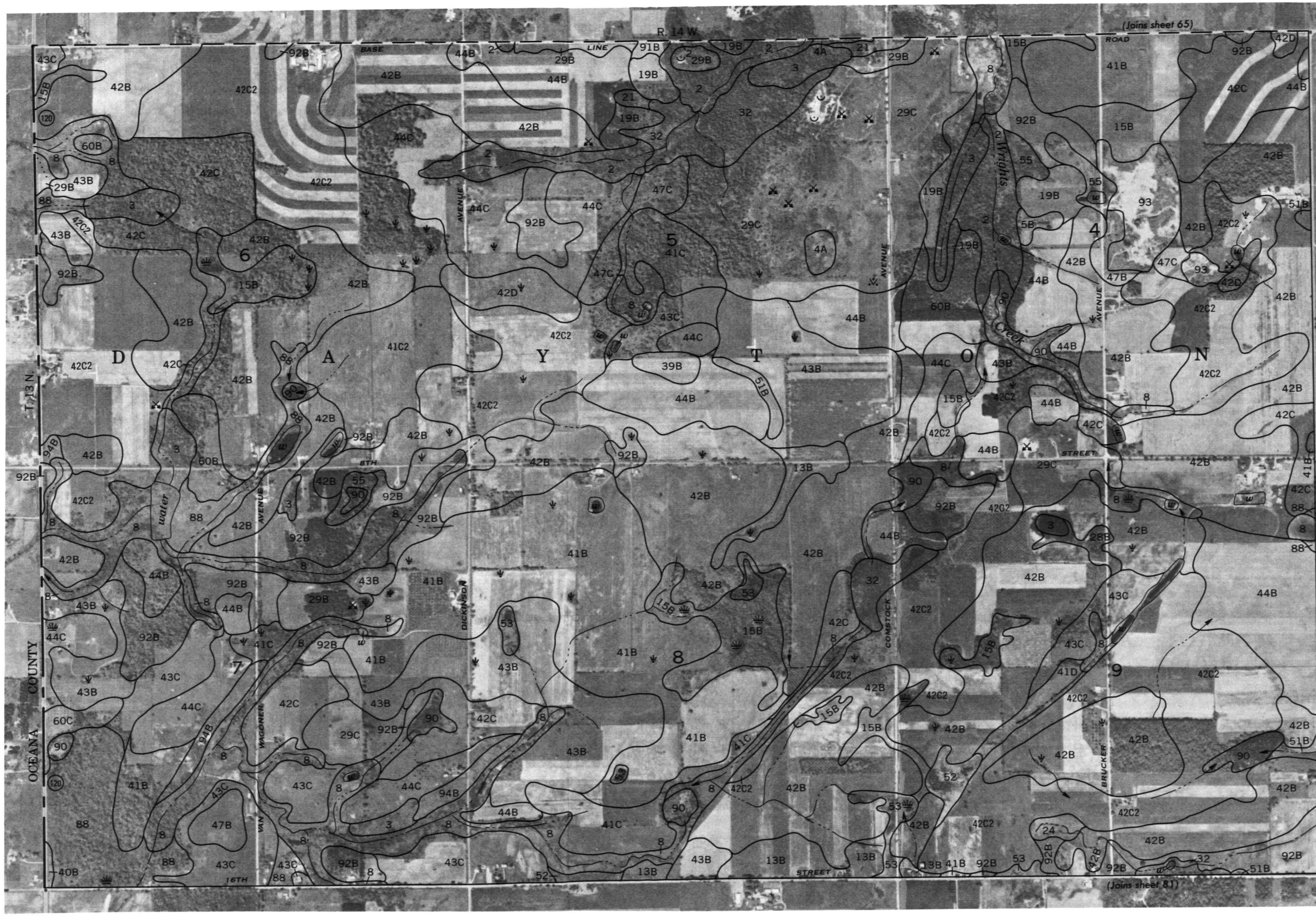
NEWAYGO COUNTY, MICHIGAN NO. 73



N

1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1

(74)

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 74

N

1 MILE

1 KILOMETER

SCALE 1:15 840

0 1/4 1/2 3/4 1

0 0.5 1

NEWAYGO COUNTY, MICHIGAN NO. 74

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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NEWAYGO COUNTY, MICHIGAN NO. 75

N

1 MILE

1 KILOMETER

SCALE 1:15 840

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 76

NEWAYGO COUNTY, MICHIGAN NO. 76

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

77

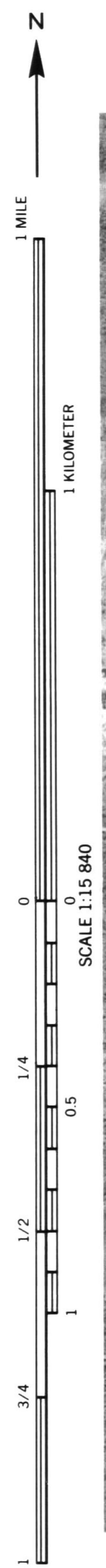
N

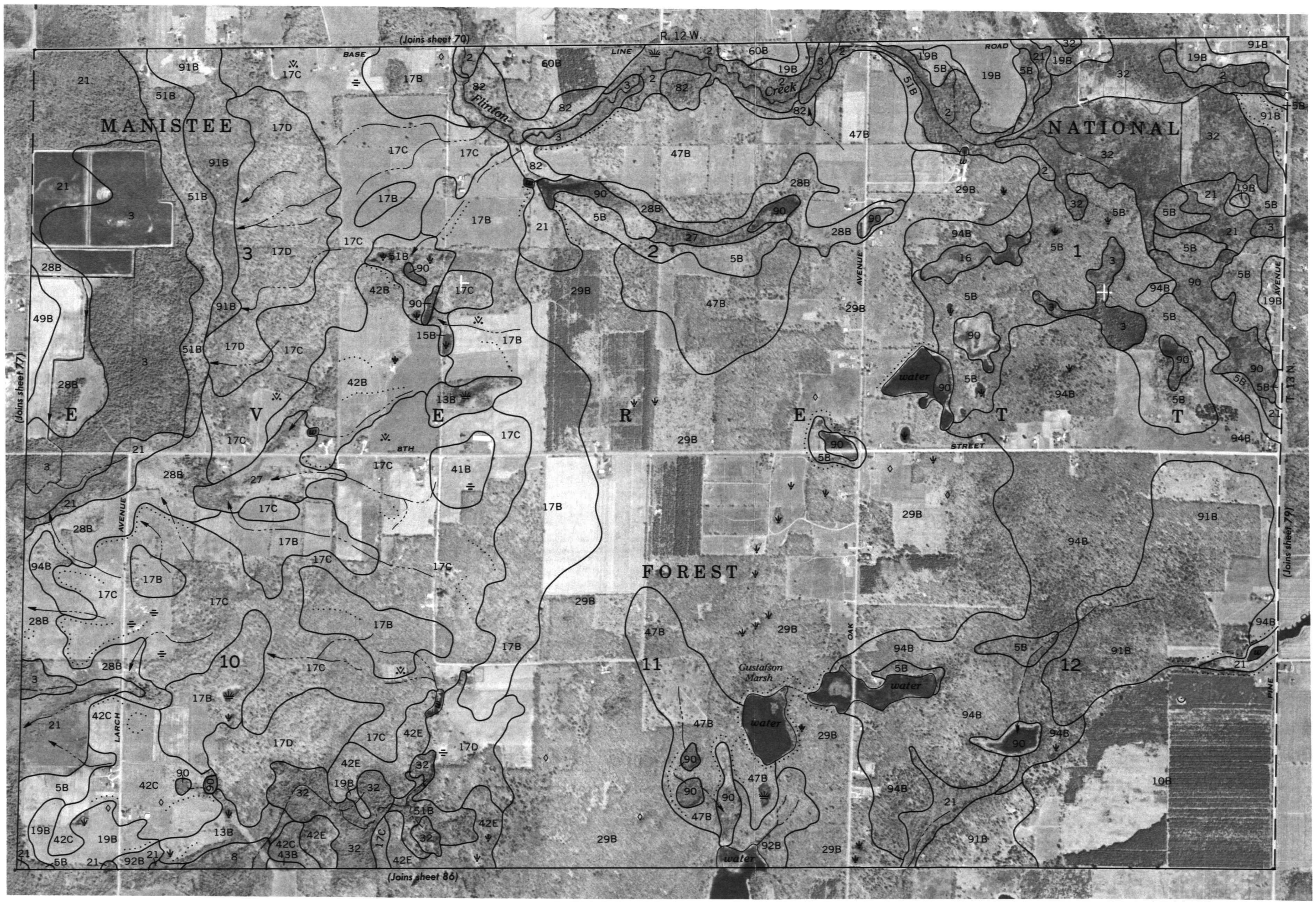
1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 77

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 78



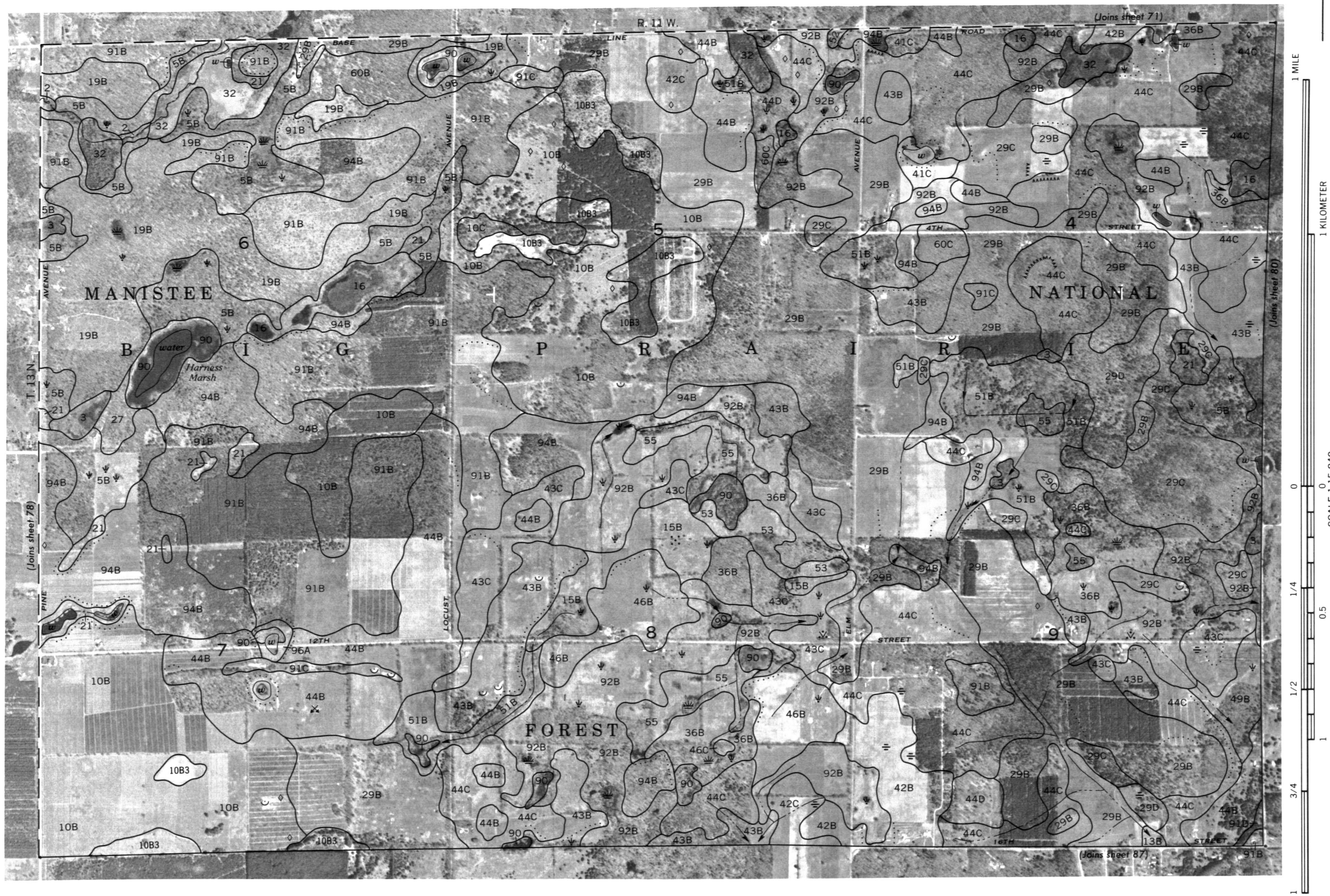


NEWAYGO COUNTY, MICHIGAN NO. 78

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 79

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 8

N

1 MILE

1 KILOMETER

SCALE 1:15 840

NEWAYGO COUNTY, MICHIGAN NO. 8

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

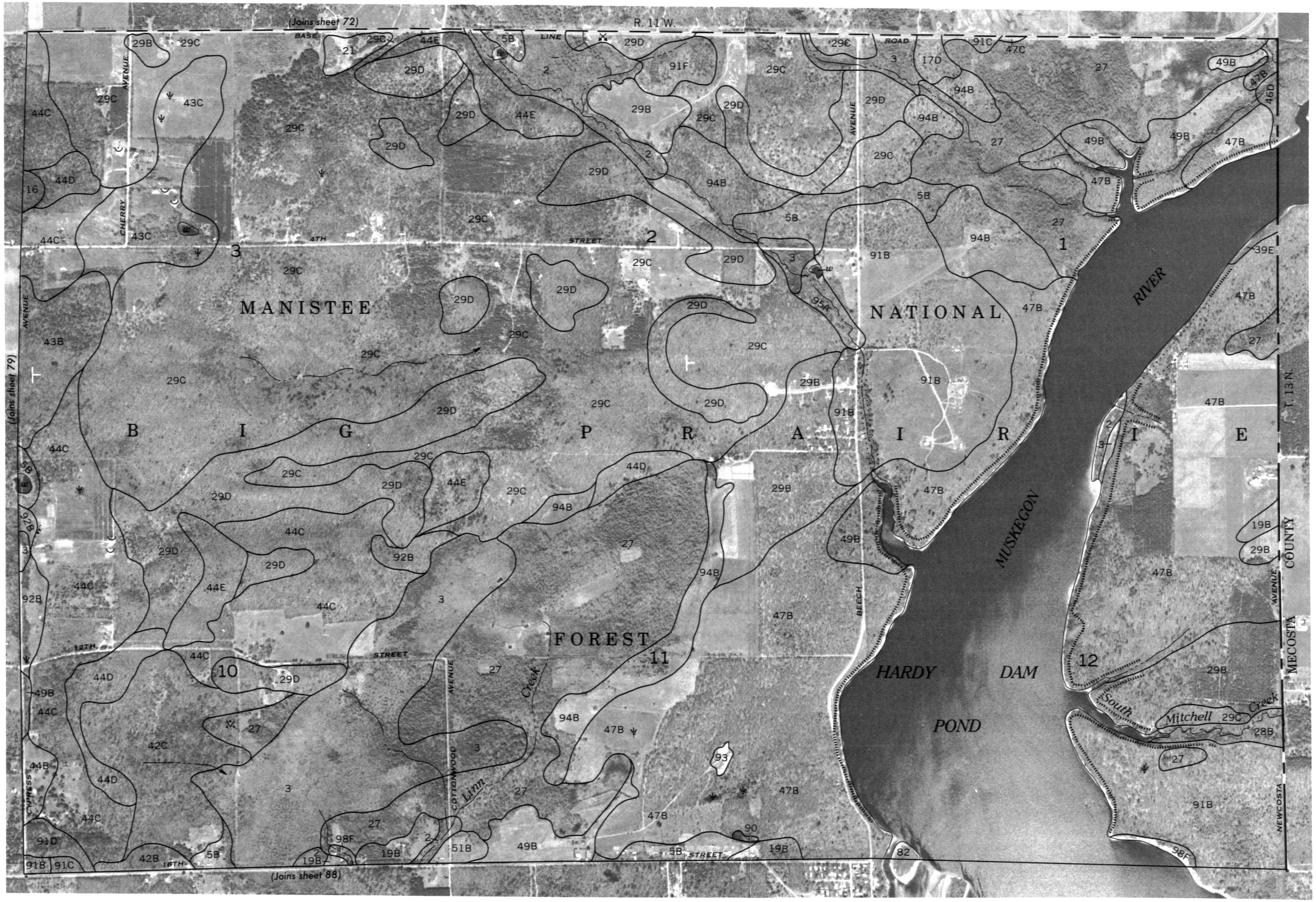
1 MILE

1 KILOMETER

SCALE 1:15 840

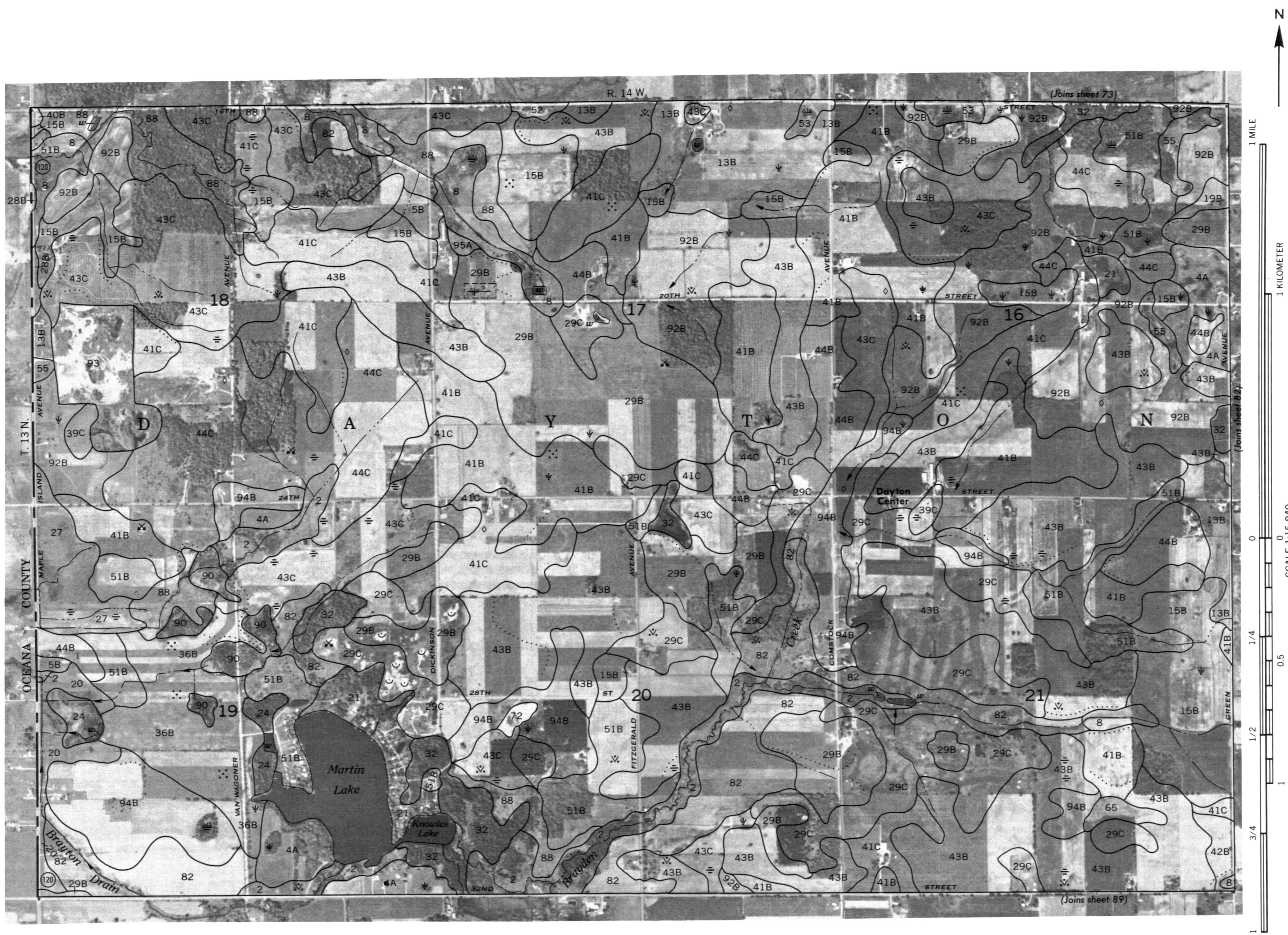
0 1/4 1/2 3/4 1

0 0.5 1



NEWAYGO COUNTY, MICHIGAN NO. 80

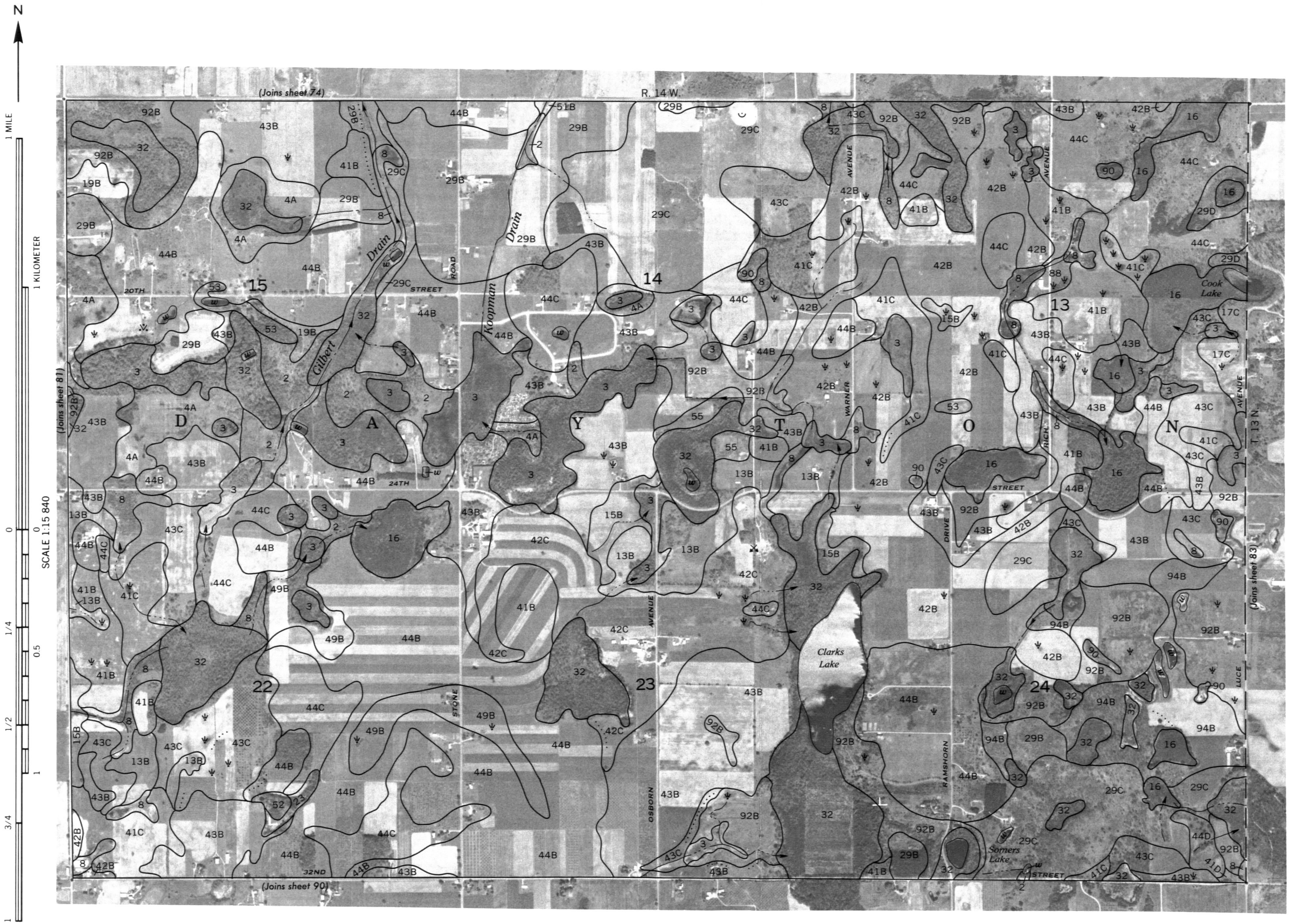
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

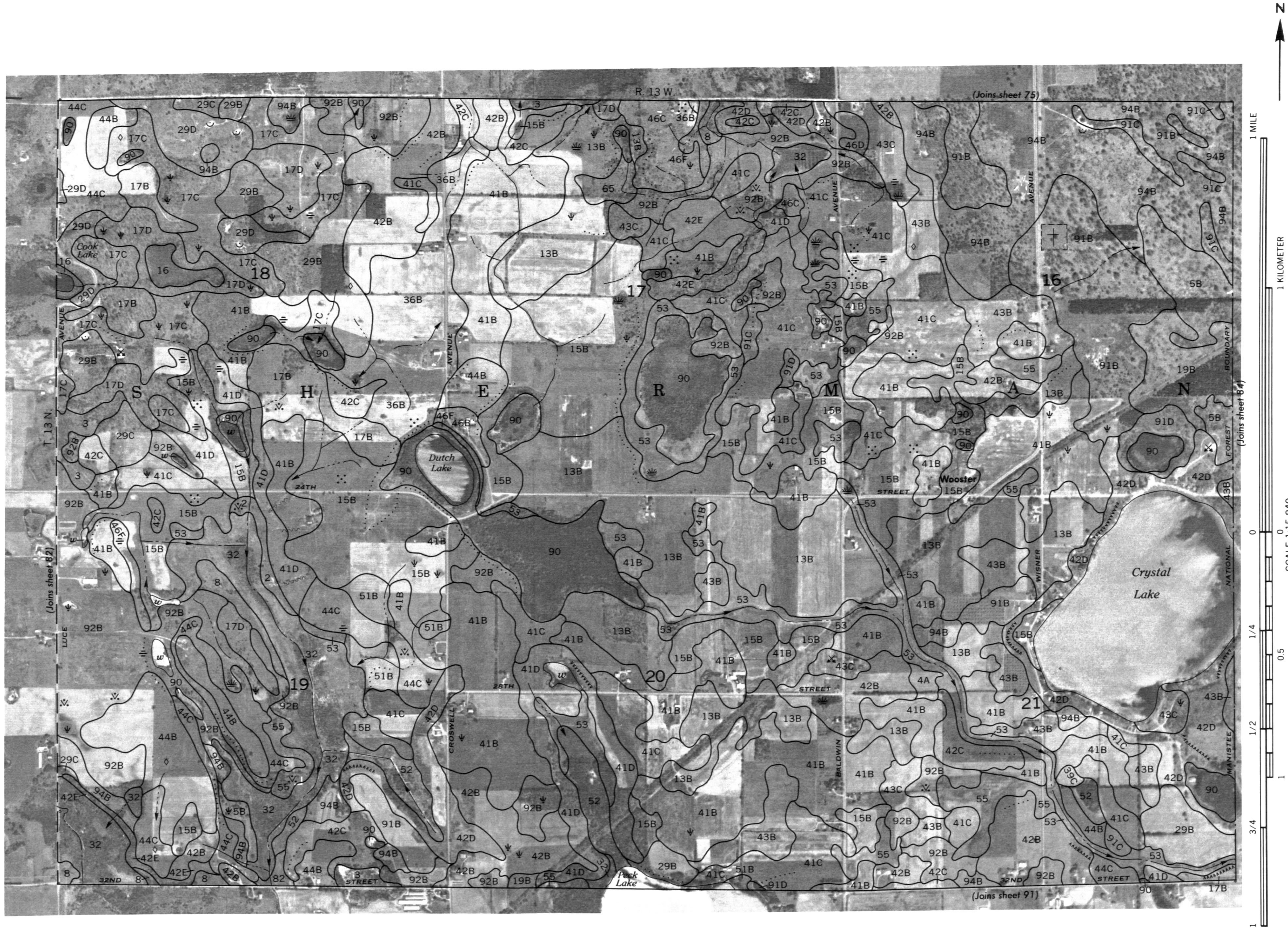
NEWAYGO COUNTY, MICHIGAN NO. 81

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 82



NEWAYGO COUNTY, MICHIGAN NO. 82

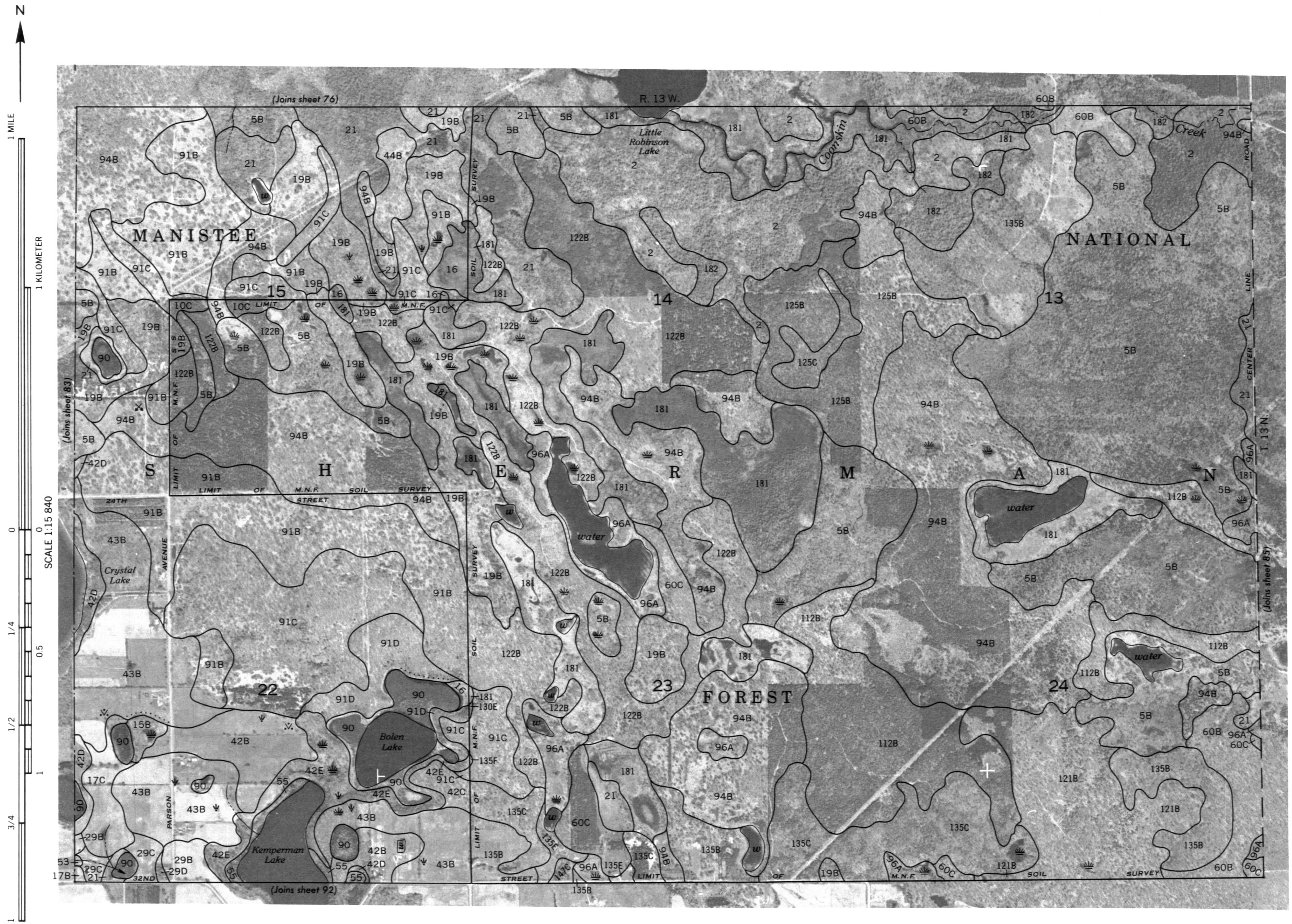
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 83

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 84



NEWAYGO COUNTY, MICHIGAN NO. 84

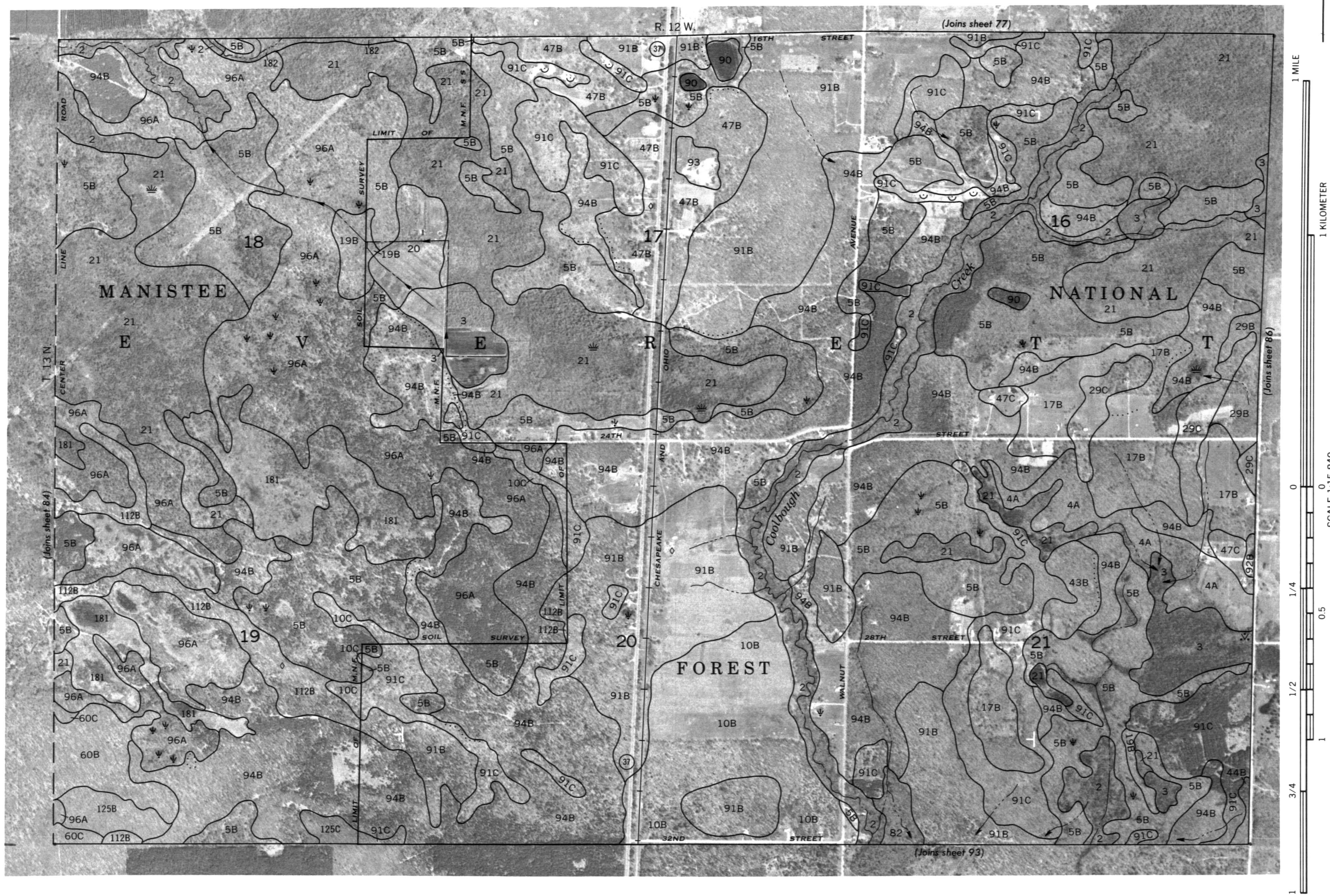
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

85

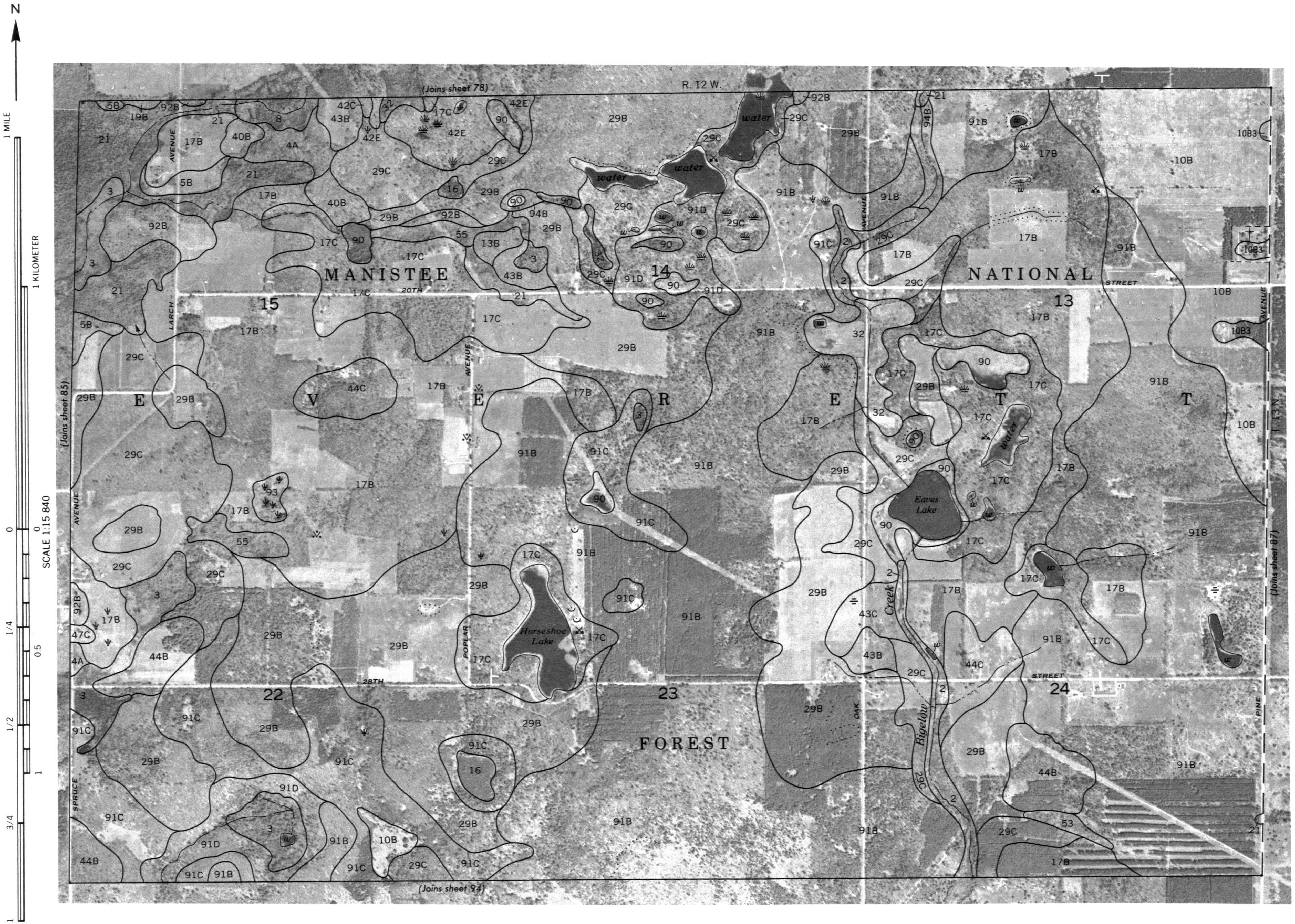
N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 85



SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 86



NEWAYGO COUNTY, MICHIGAN NO. 86

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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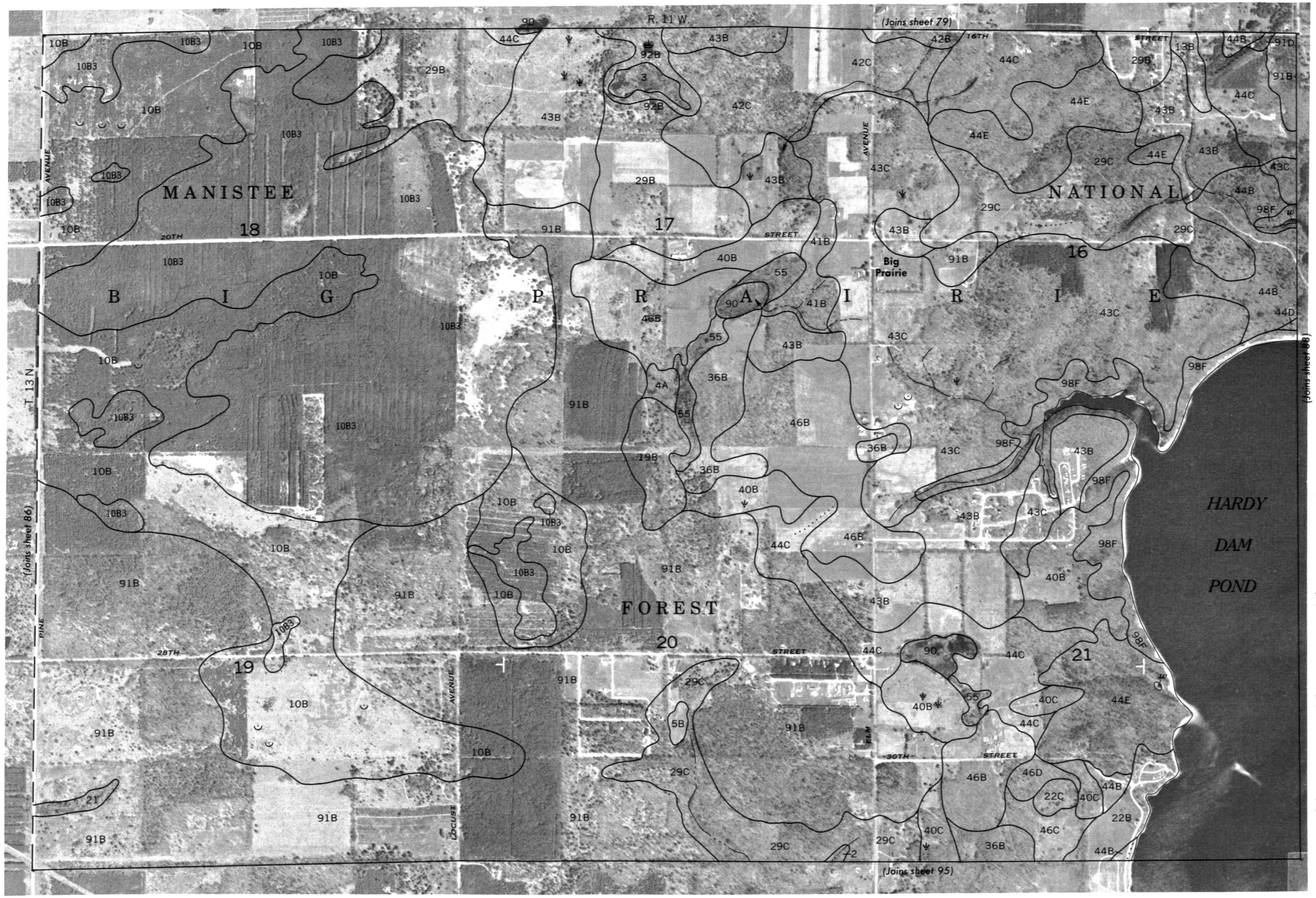
NEWAYGO COUNTY, MICHIGAN NO. 87

N



1 MILE

1 KILOMETER

0

1/4

1/2

3/4

1

0

0.5

1

SCALE 1:15 840

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 88

NEWAYGO COUNTY, MICHIGAN NO. 88

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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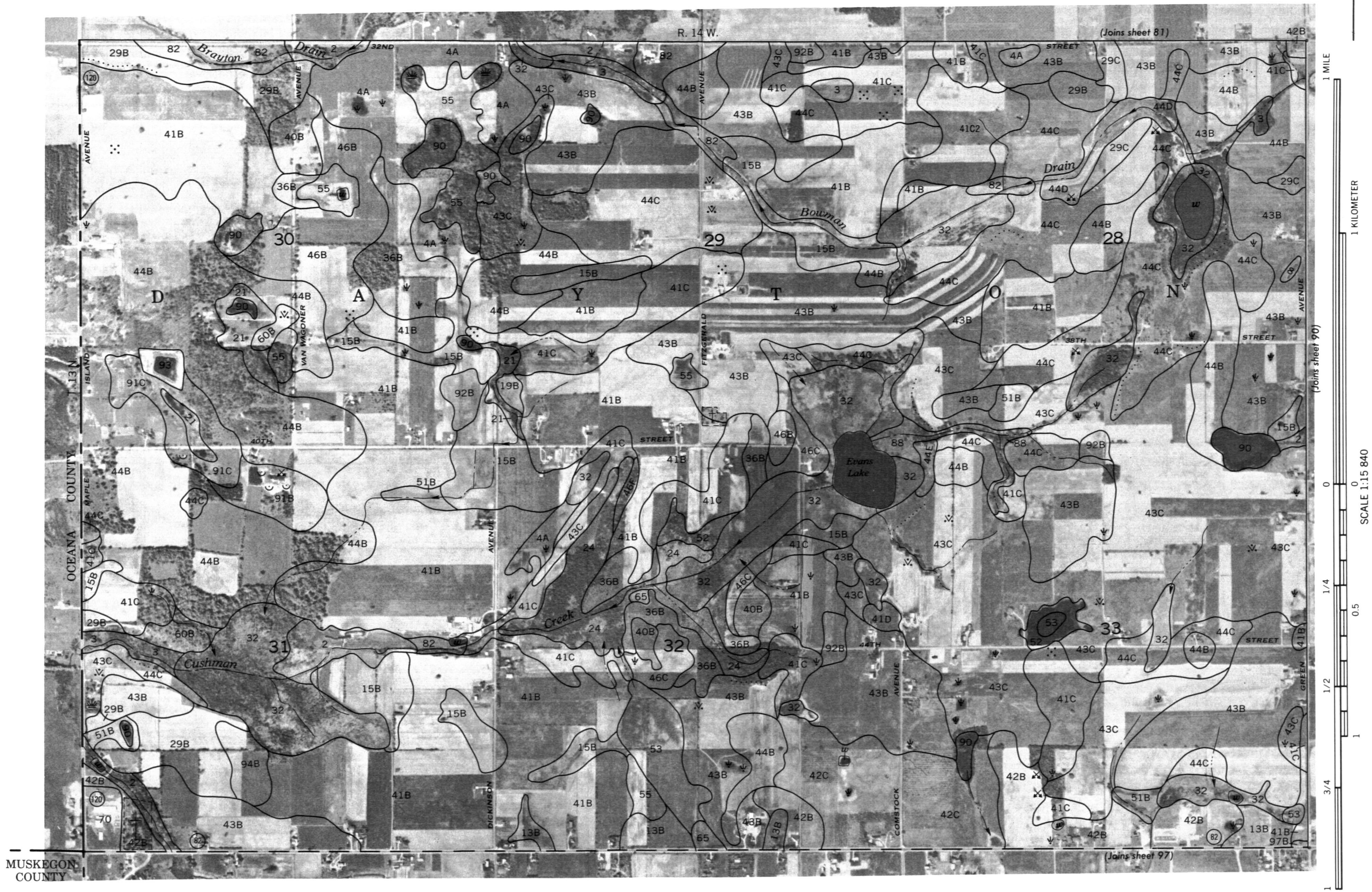
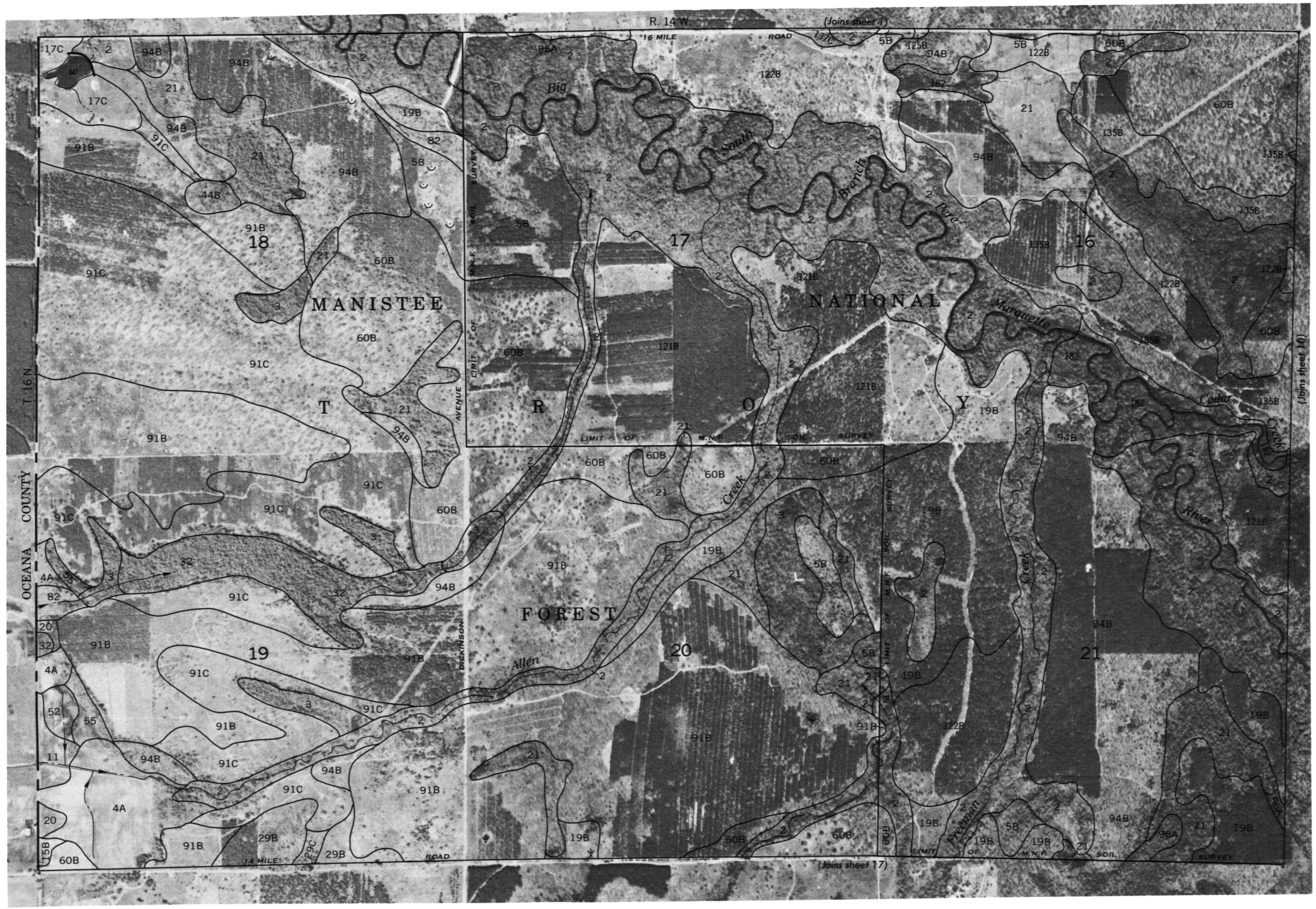
NEWAYGO COUNTY, MICHIGAN NO. 89



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

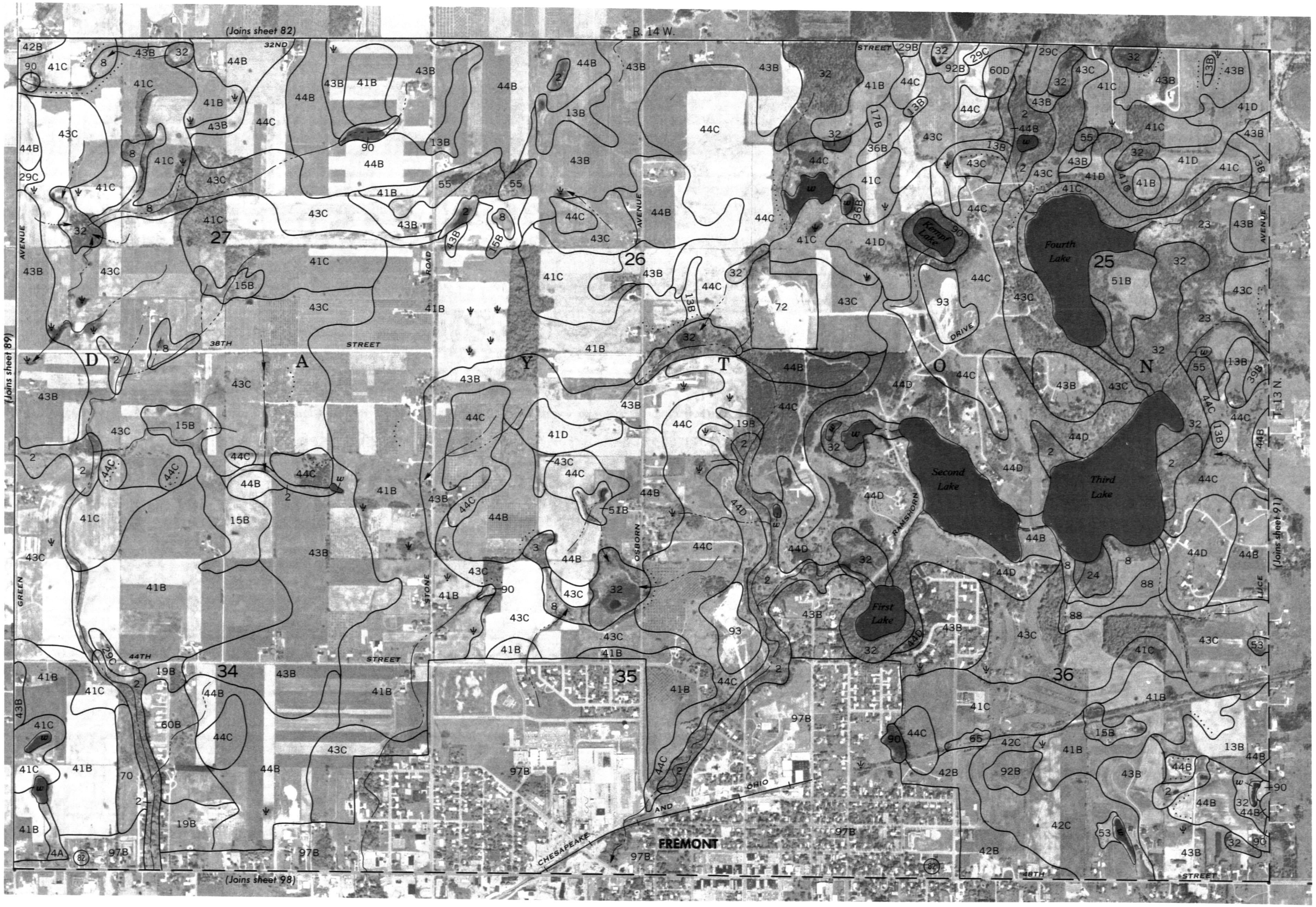
NEWAYGO COUNTY, MICHIGAN NO. 9



SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 90

N

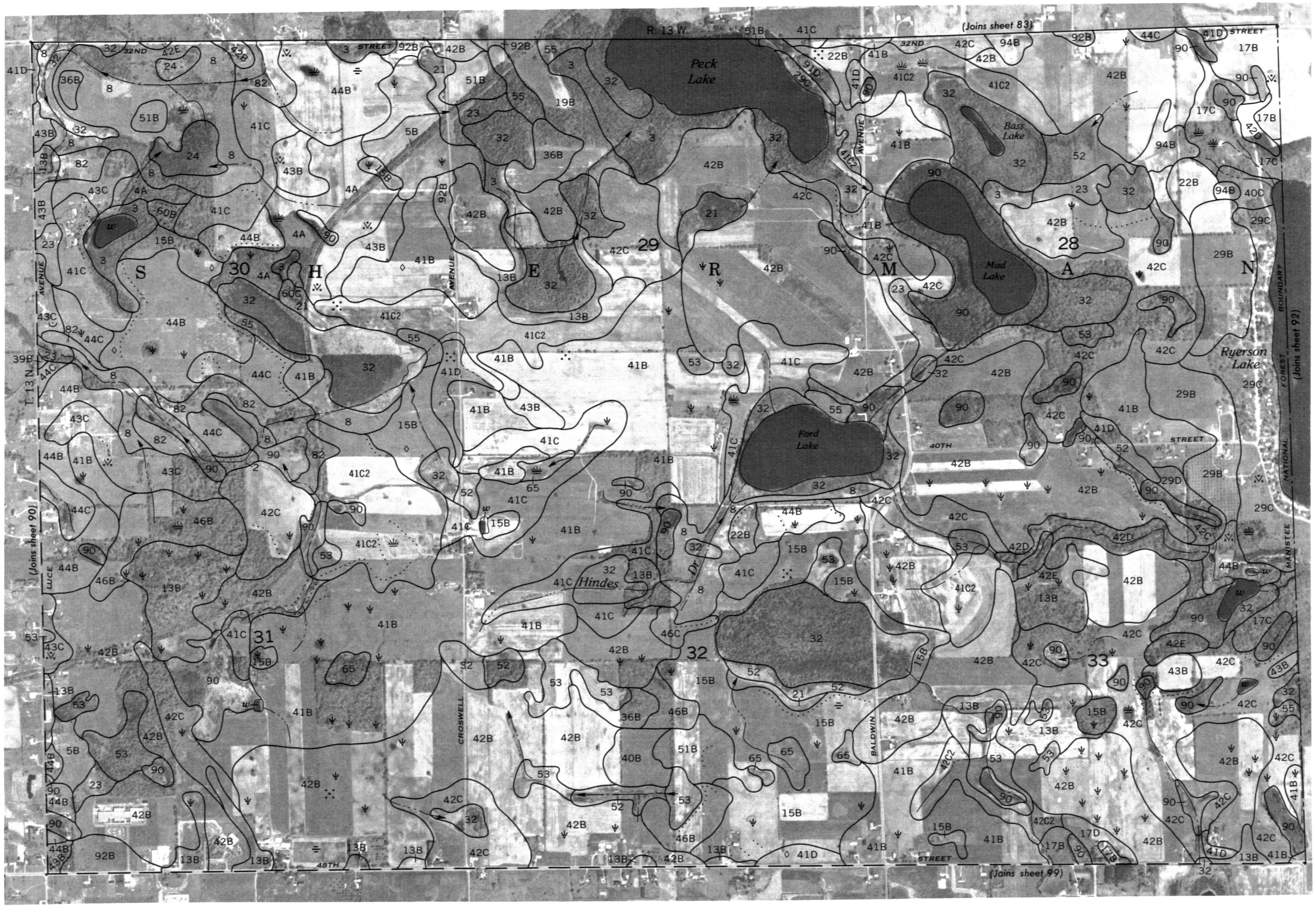
1 MILE
1 KILOMETER
SCALE 1:15 840
0 1/4 1/2 3/4 1
0 0.5 1



NEWAYGO COUNTY, MICHIGAN NO. 90

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



1 MILE

1 KILOMETER

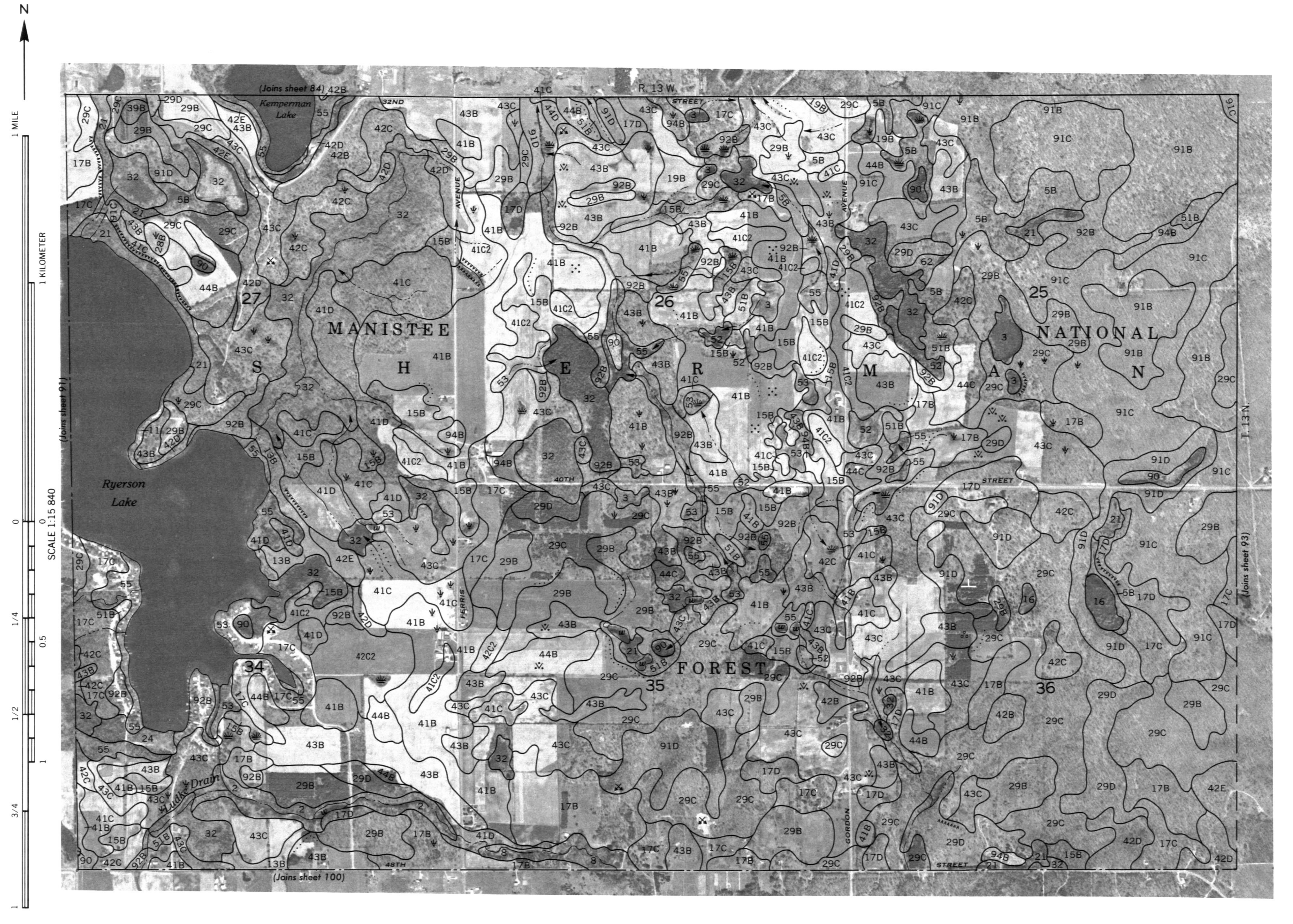
0

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 91

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 92



NEWAYGO COUNTY, MICHIGAN NO. 92

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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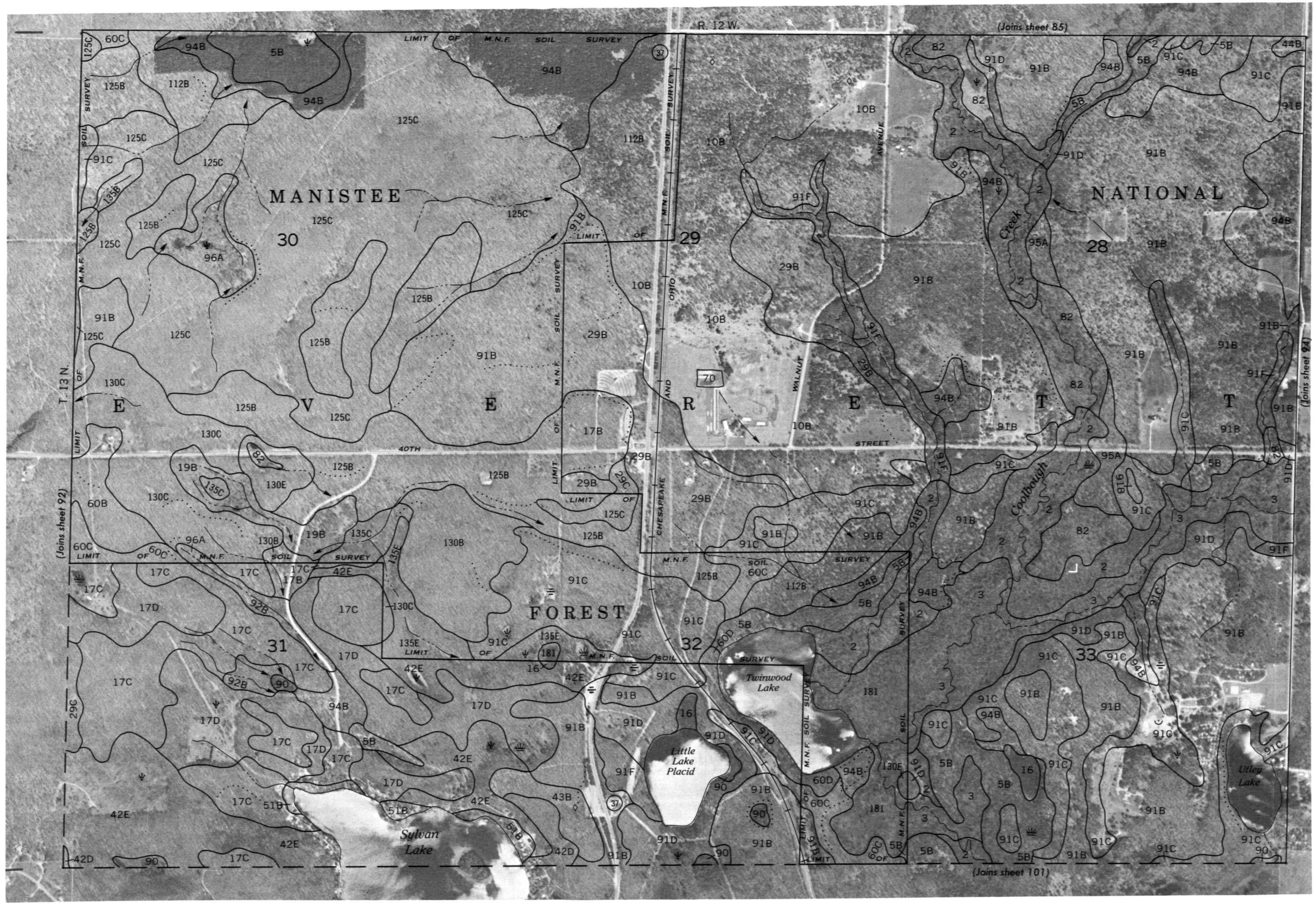
NEWAYGO COUNTY, MICHIGAN NO. 93



N

1 MILE
1 KILOMETER
SCALE 1:15 840
0
1/4
1/2
3/4
1
0
0.5
1

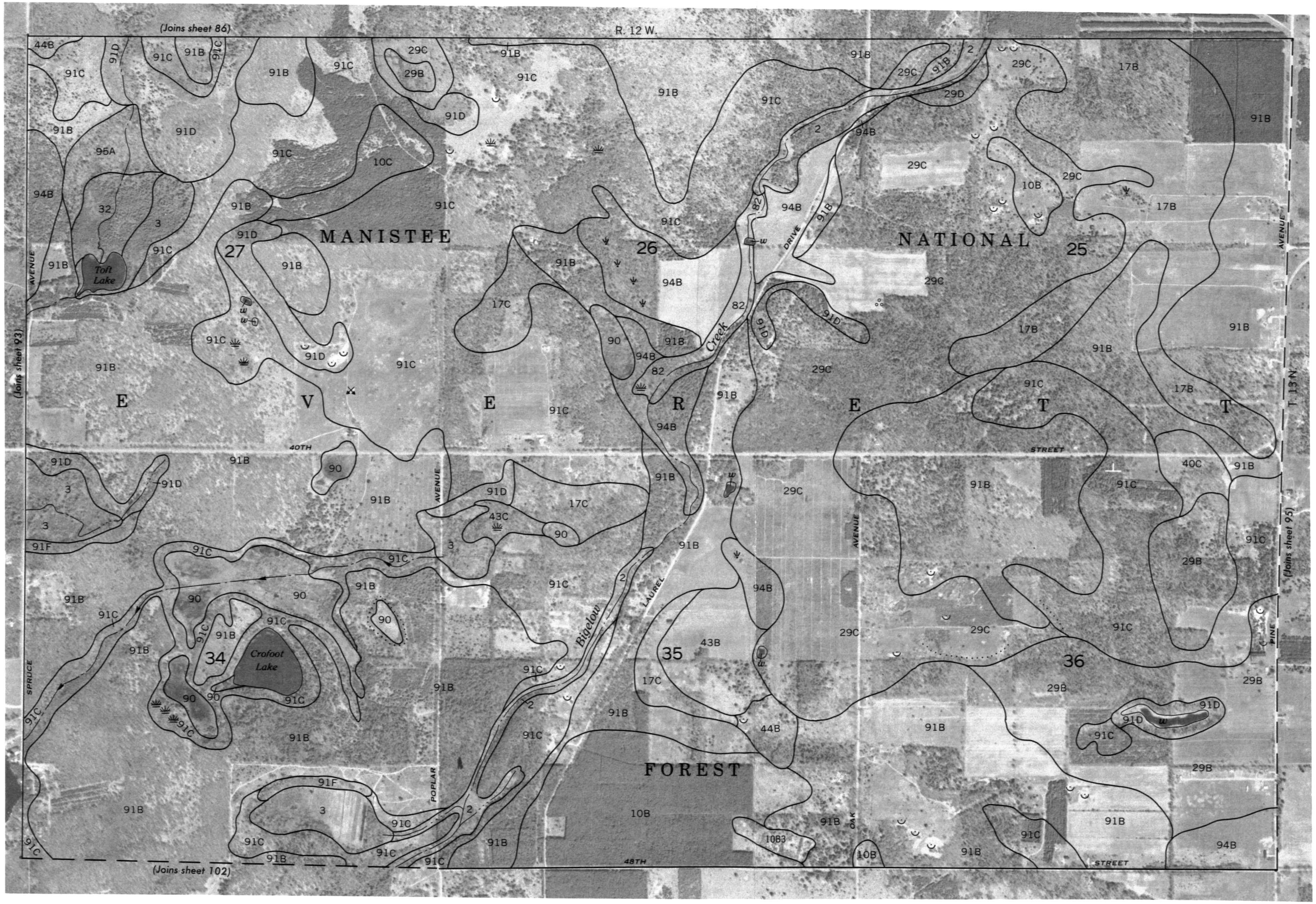
N

1 MILE

1 KILOMETER

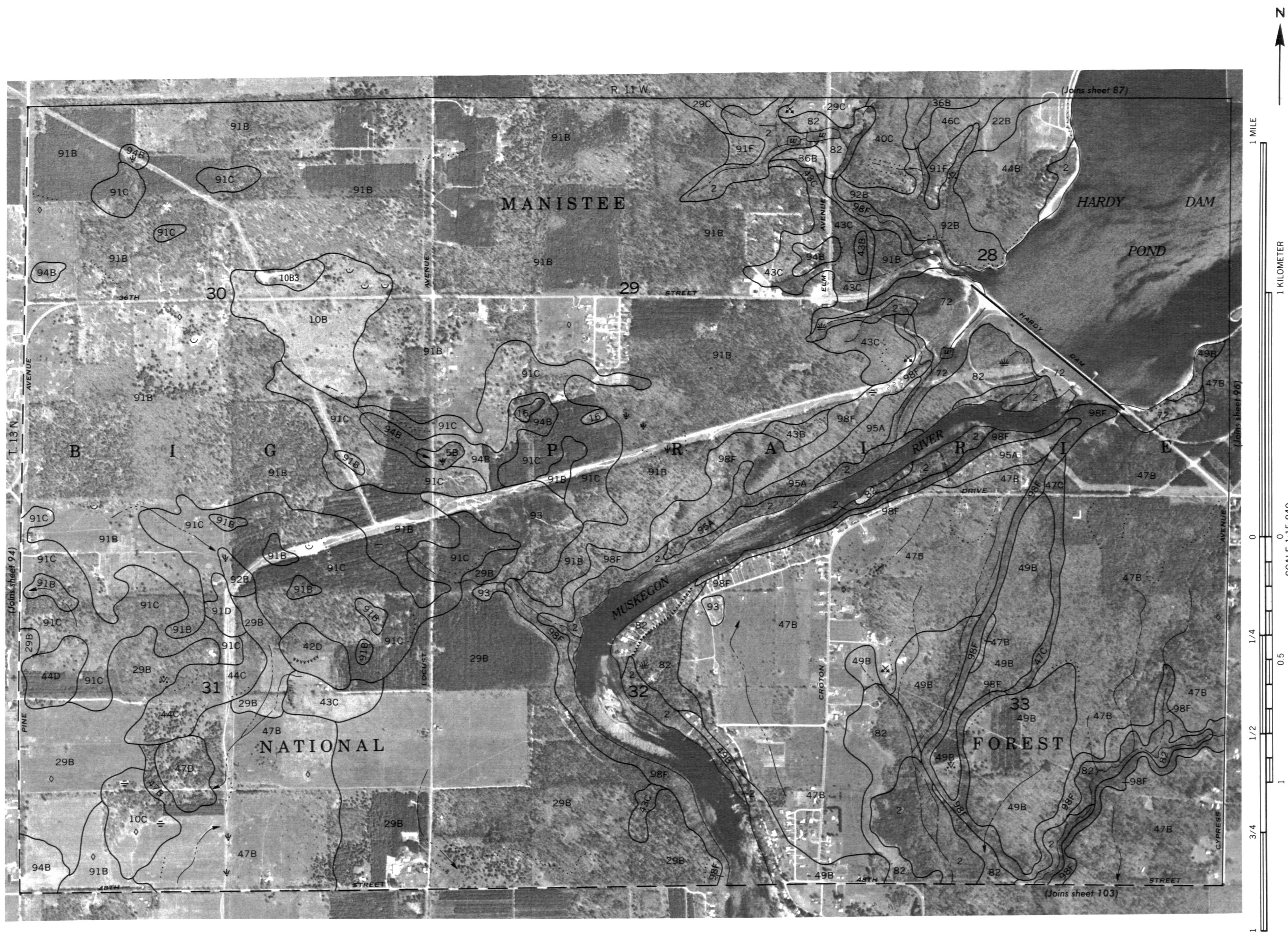
SCALE 1:15 840

0 0 1/4 0.5 1/2 1 3/4 1



NEWAYGO COUNTY, MICHIGAN NO. 94

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

NEWAYGO COUNTY, MICHIGAN NO. 95

NEWAYGO COUNTY, MICHIGAN NO. 96

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1981 aerial photography. Coordinate grid ticks and land division corners, if shown are approximately positioned.

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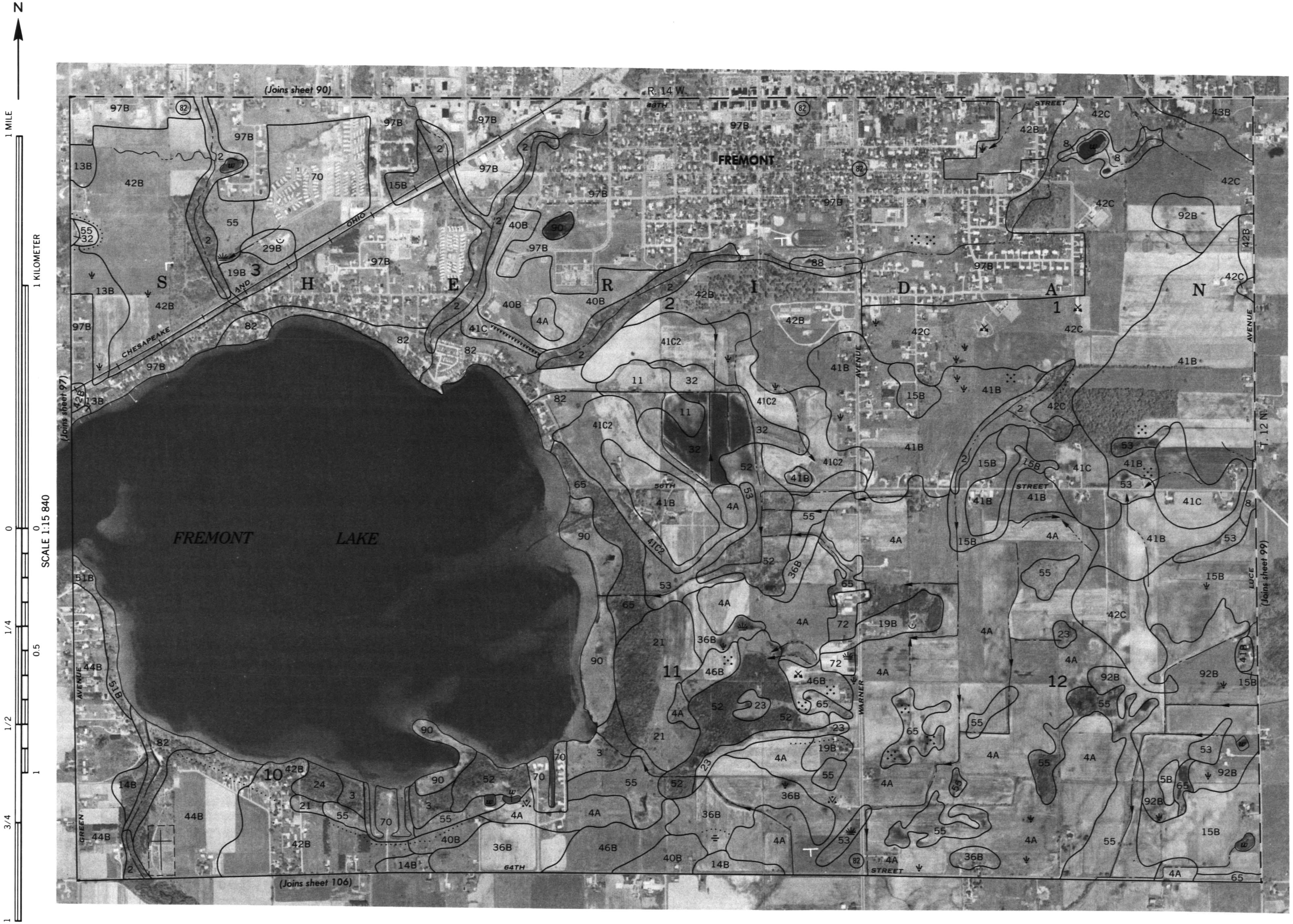
NEWAYGO COUNTY, MICHIGAN NO. 97

SOIL SURVEY OF NEWAYGO COUNTY, MICHIGAN - SHEET NUMBER 98



NEWAYGO COUNTY, MICHIGAN NO. 98

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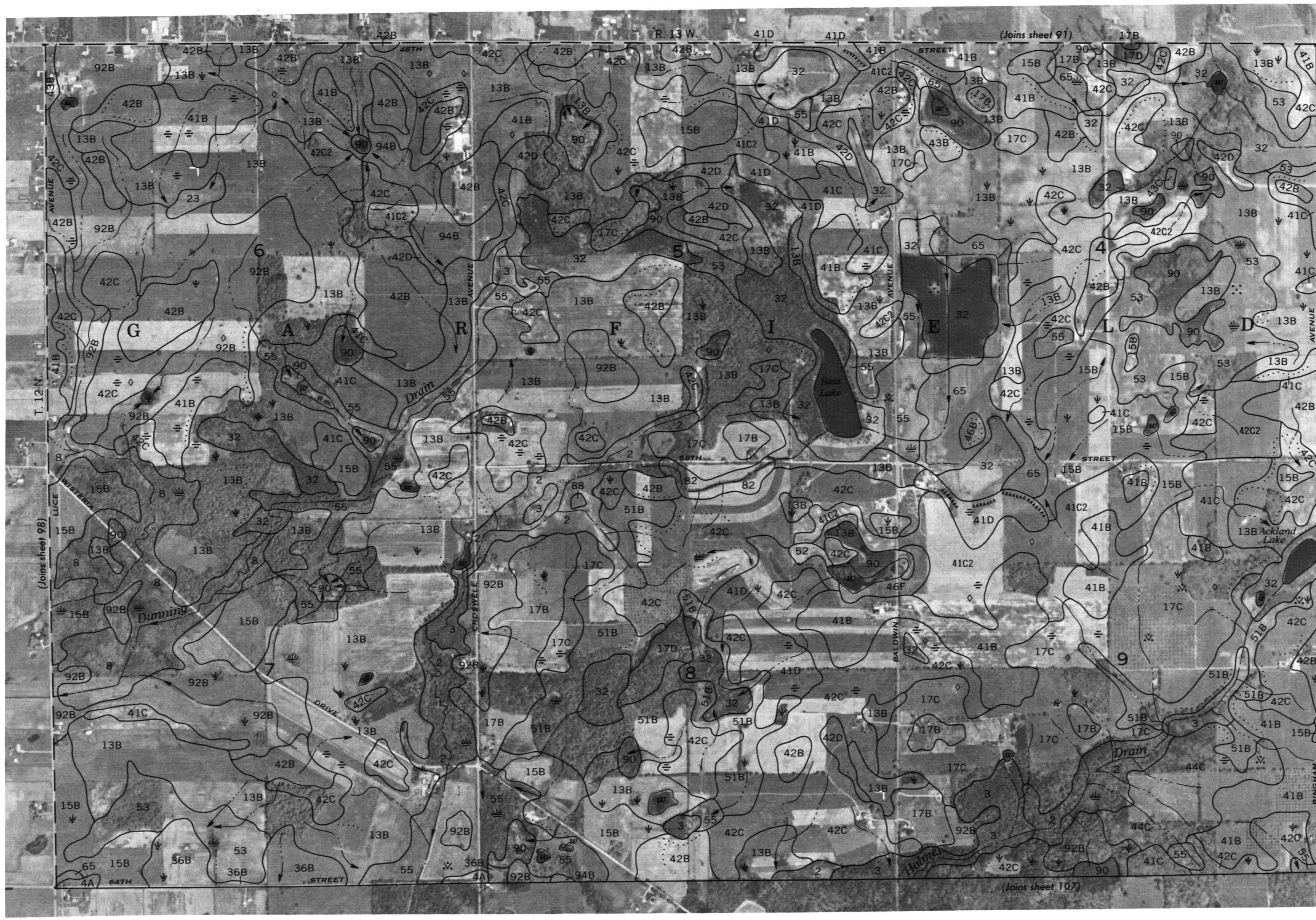
NEWAYGO COUNTY, MICHIGAN NO. 99



N

1 MILE
1 KILOMETER
SCALE 1:15 840